SCIENTIFIC AMERICAN

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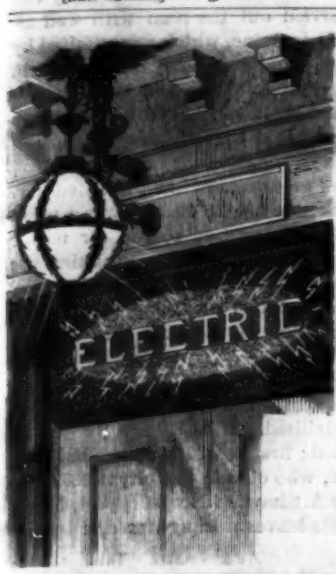


THE ELECTRIC CLUB.

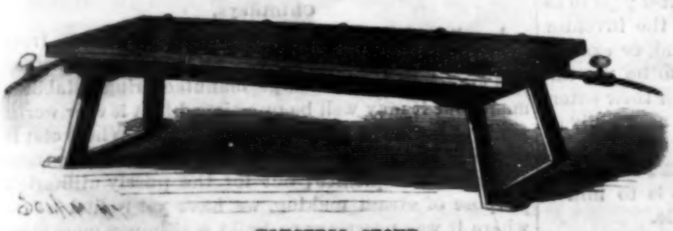
Electrical science may be said to have been established upon a new basis socially in this city when, on Tuesday, January 31st, the new headquarters of the Electric Club were formally opened. The proceedings were marked by the eminence of the invited guests, among whom were included the leading electricians of this country, as well as by the interesting address by Prof. Rowland, of the Johns Hopkins University, of Baltimore. In our present issue we illustrate some of the interior details of the club's new mansion, which throughout is fitted up with the utmost luxury. It is situated at No. 17 East 22d Street, where a building originally of great elegance, and which is now renovated throughout, is devoted to its uses.

We illustrate some of the most characteristic parts of the club house. Many of the rooms, while characterized by unusual taste in decoration, present nothing of specially distinctive interest, although much is omitted from the drawings that is well worth presentation.

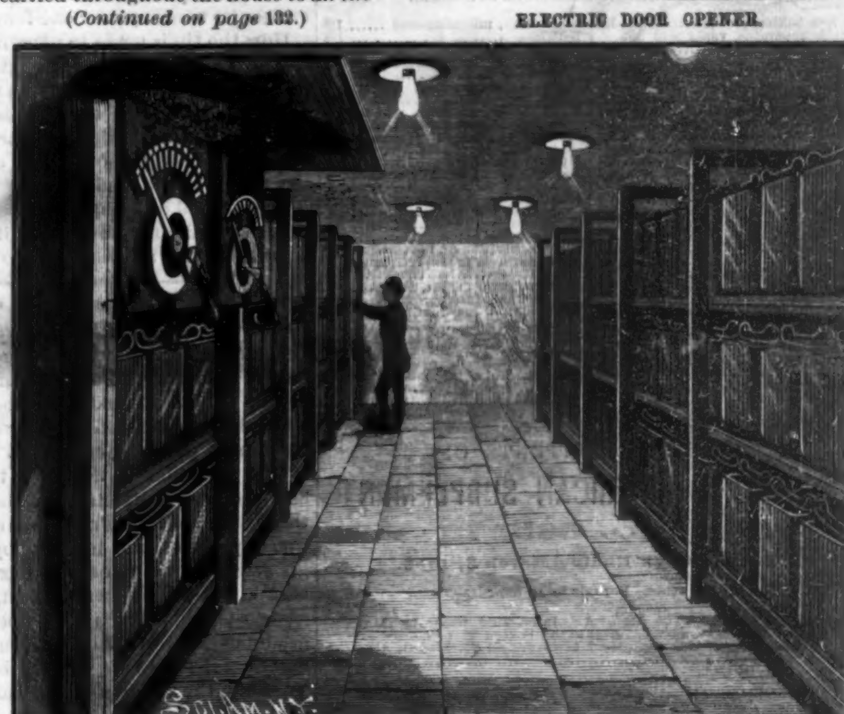
In the cellar are situated the steam boilers and the electric generating and storage plant. As is natural, this part of the installment is executed on the very best lines. It includes a high speed engine of the most advanced type, driven by independent boiler. The engine actuates two dynamos and in the cellar adjoining it a large storage battery is installed. In connection with these elements of the generating plant are ammeters and controlling apparatus, and a very elaborate switch board for directing the course of the currents. From this plant leads are carried throughout the house to all the

(*Continued on page* 132.)

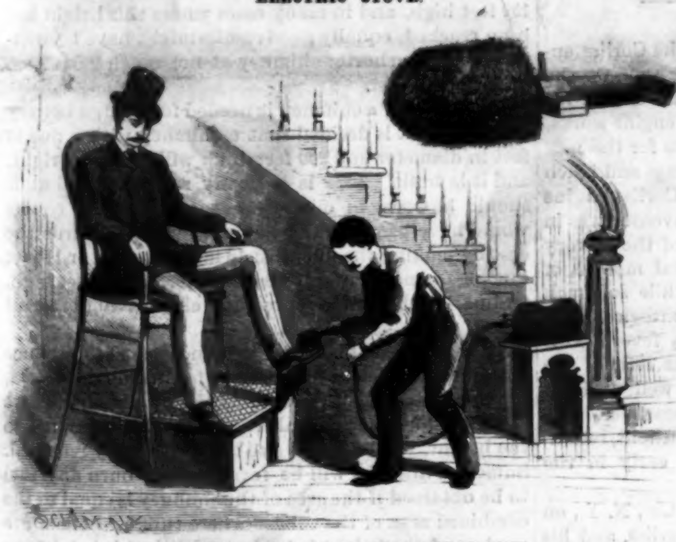
ELECTRIC DOOR OPENER.



ELECTRIC STOVE.



STORAGE BATTERY ROOM.



ELECTRIC SHOE BLACKING APPARATUS.

LECTURE ROOM.

LONG DISTANCE TELEPHONE.

THE NEW ELECTRIC CLUB HOUSE OF NEW YORK CITY.

Scientific American.

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NEW YORK, SATURDAY, MARCH 3, 1888.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 635.

For the Week Ending March 3, 1888.

Price 10 cents. For sale by all newsdealers.

Is Chicago to Have Natural Gas?

Chicago, with its usual progressive spirit, is now contemplating the introduction of natural gas into the city by pipe lines. The design is to transmit the gas from wherever it may be found, the latter problem being the most difficult to solve. A writer in one of the Chicago papers states that the pipe lines will be fed by wells, perhaps hundreds of them, wherever they may be found, near or remote from the city. A Mr. W. W. Gibbs, who seems to be interested in the scheme, says to a reporter of one of the papers:

"We have been prospecting several months, and we have located some wells close to the city. Where these wells are I will not say. Of course, it is to our interest to obtain a sufficient supply of gas as near the city as possible, and we will try to. But we are prepared to go 200 miles, if necessary, into Indiana, where we know gas fields exist. The chief obstacle in the transmission of gas heretofore has been large piping that would resist high pressures. Wrought, cast and welded iron pipes are the only ones that have been in use. They are very heavy and very expensive. The pipes oxidize and rust, and the gas escapes through the pores. What we will use is a seamless steel pipe, prepared by a new process devised and owned by W. H. Brown, of New York. I do not know how long it will take to operate the scheme," he adds, "but we will have the pipe ready in five or six months."

To another reporter, the inventor explained his process for making his steel pipe as follows:

"A disk of mild steel is first taken and folded under heat. It is drawn cold over mandrels into tubes, and rolled and worked by specially constructed machinery into any required length and thickness. It is cleaned by acids, and a proportion of tin is applied to the inside, which penetrates the fiber of the steel and increases its tensile power one-fourth."

How the tin is made to penetrate the steel pipe so as to increase its *power*, or strength, which the inventor probably meant, is difficult to understand, or exactly where the gas is to come from seems to be yet undecided. But the Chicagoans are noted for their enterprise, and they will overcome obstacles as readily as any people in the land.

The method of bringing the gas into the city seems to be settled, and now the thing to do is to find a natural deposit as near Chicago as possible.

George Henry Corliss.

George Henry Corliss, the inventor of the Corliss engine, died at his residence in Providence, R. I., on the 21st of February. Paralysis of the heart caused his death. About a week before, he left the engine works, where he was engaged in the preparations for the new Pawtucket pumping engine. The drawings and much of the preliminary work for the new Corliss engine had also been completed, and the great inventor was in the best of spirits. The reorganization of the factory was in progress, and had employed several months of his attention. But on the next day, while so much that interested him was on foot, he was attacked with gastric trouble which developed into a fever. This gradually left him, only to return on the 19th of the month. He was supposed to be doing well until on Tuesday, the 21st, paralysis made its appearance. His case was then pronounced hopeless. The patient, retaining consciousness to the last, expired early in the afternoon.

He was born in Easton, Washington Co., N. Y., on June 2, 1817. His father, Dr. Hiram Corliss, and his mother were natives of the same village. In 1825 his father moved to Greenwich, in the same county, where he sent his son to school. At the age of fourteen he left the village school and entered an academy at Castleton, Vt. In 1838 he began his active life, leaving the academy and opening a store in Greenwich. A bridge had been carried away by a freshet when he first gave evidence of his mechanical genius. He devised a plan for its reconstruction which was pronounced impracticable, but which was successfully carried out. He next constructed a machine for stitching leather, which antedates by many years the invention of Howe. He moved to Providence, R. I., in 1844, associating himself with John Barstow and E. J. Nightingale under the firm name of Corliss, Nightingale & Co., and in 1846 began to develop and improve the steam engine. It is said that he never saw the inside of a machine shop until he was twenty-five years old. Yet his improvements were pushed with such energy that in 1849 they were practically completed and a patent was procured. In this early machine were embodied the leading features of the world-renowned Corliss engine. The invention has proved revolutionary in its effects upon steam engine practice.

In 1856 the Corliss Steam Engine Co. was incorporated. It grew rapidly, and now covers several acres of ground, while it has supplied many hundreds of engines to steam consumers all over this country and abroad. Mr. Corliss was from the beginning the president of this company.

Many awards were received by him in America and Europe. At Paris he received the prize of the 1867 exposition. On January 11, 1870, the Rumford medal was presented him by the late Dr. Asa Gray, then president of the American Academy of Arts and Sciences. At the 1873 exhibition in Vienna he received the grand diploma of honor for the excellence of his system, then extensively adopted by Continental engine builders. The Institute of France in 1878 awarded him the Montoyon medal, the highest honor for mechanical achievement. In February, 1886, the King of Belgium made him an officer of the Order of Leopold.

In 1872 he was appointed Centennial Commissioner from Rhode Island. He conceived the idea of driving the machinery of the Centennial exposition by one great engine, and carried out the plan with well remembered success. The engine, which was admired by so many as it ceaselessly and noiselessly did its work in Philadelphia in 1876, represented one of the culminations of his life work. M. Bartholdi, in his report to the French government, said that this engine formed a work of art.

He was the object of great regard in his adopted city. He was in the State Senate in 1868-70, and was a presidential elector in 1876. He refused to run for mayor or governor, though often solicited, once declining the gubernatorial nomination after a unanimous choice by the convention. He was one of the commissioners who had charge of the erection of the new City Hall of Providence.

By his death America loses one of her most distinguished sons, and his death will meet with widespread regrets from all the civilized world.

He was twice married; first in 1839 to Phebe F. Frost, of Canterbury, Conn., who died in this city in 1859, and again in 1866 to Emily A. Shaw, of Newburyport, Mass., who survives him. He leaves a daughter and son by his first wife.

Chimneys.

A well proportioned chimney, of neat design, from 200 to 300 feet high, is always an imposing structure and an ornament to a large manufacturing establishment, but it may well be questioned if it is ever worth while to build them over 150 feet high. Where cost is no consideration there is no objection to building them as high as one pleases; but for the purely utilitarian purpose of steam making, we have yet to find a case where it was necessary to build a chimney more than 150 feet high, and in many cases where this height has been reached, equally good results might have been attained with a shorter chimney at not much more than one-half the cost.

For example, a chimney is needed for a large battery of boilers. It is decided that a chimney with a flue 10 feet in diameter and 250 feet high will be about right, and it is built. This is perfectly satisfactory, but it should be borne in mind that exactly the same results would have been attained at not over two-thirds the cost by making the flue just 16 inches larger, or 11 feet 4 inches diameter, and 100 feet shorter, or 150 feet high. Ordinarily, this would represent a clear saving of about $5,000.

After a sufficient height has been reached to produce draught of sufficient intensity to burn fine, hard coal, provided the area of the chimney is large enough, there seems no good mechanical reason for adding further to the height, whatever the size of the chimney required. Sufficient draught will be furnished to burn any fuel to be obtained if the area of the chimney is equal to the combined area of the tubes—where tubular boilers are used—and the height is 100 feet. With this height the area of the chimney may also be made equal to one-eighth of the grate surface, that being about the ratio existing between tube area and grate area when boilers are well proportioned. A much less height than 100 feet cannot be recommended for a boiler chimney, for the reasons above given. The lower grades of fuel cannot be burned as they should be with a shorter chimney.—*Locomotive.*

The Hartford Boiler Insurance Co.

We have received a note of the operations and condition of this pioneer company from the Secretary, Mr. J. B. Pierce. The extent to which the business of inspecting and insuring boilers has grown may be judged from its showing. A corps of eighty-five inspectors are kept busily employed in the company's service, and it had in its charge no less than 25,113 boilers on Jan. 1, 1888. This indicates a most desirable condition of things, when steam users are ready to take every precaution to avert disaster. The total assets of the company exceed one million of dollars, and the condition of its liabilities is most satisfactory, they being divided between capital stock, surplus, and reserves. The president is Mr. J. M. Allen, the vice-president Mr. Wm. B. Franklin. Before giving a policy, the company have the boiler carefully inspected, not by mere hydraulic pressure, but by an intelligent hammer test and general examination. This not only discloses any weakness, but the extent and location of the same. Thus their policy carries with it the benefits of a most careful examination, which in itself may be of incalculable benefit to the owner of the boiler.

POSITION OF THE PLANETS IN MARCH.

MARS

is morning star, and takes the lead on the planetary record for February, for he is near the culmination of his size and brilliancy. He rises on the 1st of the month, in the southeast, about 10 o'clock in the evening, and is easily recognized as a large ruddy star, 9° northeast of Spica. He rises on the last of the month near half past 7 o'clock, and is then about 5° northeast of Spica, approaching the bright star during the month. Mars rises on the 1st at 9 h. 43 m. P. M. On the 31st he rises at 7 h. 20 m. P. M. His diameter on the 1st is 12·4", and he is in the constellation Virgo.

JUPITER

is morning star, and is increasing in brilliancy as he approaches the earth. On the middle of the month he looms above the southeastern horizon about midnight, the most radiant star in the whole heavens, till Venus appears upon the scene. Jupiter rises on the 1st at 12 h. 46 m. A. M. On the 31st he rises at 10 h. 54 m. P. M. His diameter on the 1st is 36·2", and he is in the constellation Scorpio.

VENUS

is morning star. She is charming to see for the short time she is above the horizon, nearly an hour and a half before sunrise on the 1st, and only three quarters of an hour before sunrise on the 31st. Venus rises on the 1st at 5 h. 7 m. A. M. On the 31st she rises at 4 h. 50 m. A. M. Her diameter on the 1st is 13", and she is in the constellation Sagittarius.

URANUS

is morning star. He is near Theta Virginis and northwest of Spica, and in fine position for observation with the telescope or with the naked eye. Uranus rises on the 1st at 8 h. 38 m. P. M. On the 31st he rises at 6 h. 33 m. P. M. His diameter on the 1st is 3·8", and he is in the constellation Virgo.

SATURN

is evening star. He is now retrograding or moving backward, and seems to be approaching Pollux on the northwest and Procyon on the southwest, the two bright stars that are guides to his position. He is on the meridian on the 1st at 9 h. 29 m. P. M., and is in most favorable position for observation with the telescope. Saturn sets on the 1st at 4 h. 43 m. A. M. On the 31st he sets at 2 h. 43 m. A. M. His diameter on the 1st is 18·8", and he is in the constellation Cancer.

NEPTUNE

is evening star. He sets on the 1st at 12 h. 6 m. A. M. On the 31st he sets at 10 h. 11 m. P. M. His diameter on the 1st is 2·4", and he is in the constellation Taurus.

MERCURY

is evening star until the 3d, and then morning star. He is in inferior conjunction with the sun on the 3d at 2 h. P. M. He reaches his greatest western elongation on the 30th, at 9 h. P. M., and is 27° 49' west of the sun. He is then visible to the naked eye as morning star in the east before sunrise, but he is so far south of the sun that he will be hard to find. He is in conjunction with Venus on the 27th, at 8 h. P. M., the planets being but 2' apart. Mercury sets on the 1st at 6 h. 10 m. P. M. On the 31st he rises at 4 h. 48 m. A. M. His diameter on the 1st is 10·4", and he is in the constellation Pisces.

At the close of the month Mercury, Venus, Jupiter, Mars, and Uranus are morning stars. Saturn and Neptune are evening stars.

PHOTOGRAPHIC NOTES.

Device for Igniting Magnesium Compounds.—A simple arrangement for safely igniting flash light magnesium compounds was exhibited by Mr. Thos. McCollin on the 14th ult., at the Society of Amateur Photographers, in this city, which may be described as follows: An upright stand 4 in. in height, supporting a metal pan about 2 in. square, on which the flash compound was placed. Behind the pan was an alcohol flame, and back of that, projecting into the flame, was a blowpipe tube bent in such a way as to project a jet of air through the alcohol flame horizontally upon the surface of the metal pan. The blowpipe tube was connected by a rubber pipe to a pneumatic bulb; a sudden compression of the latter forced a horizontal flame of alcohol across the pan, which at once ignited the flash compound. The advantage claimed for it was that the operator could stand quite a distance from the flame, and that the sitter would not be disturbed by any preliminary lighting of a taper or match.

In focusing at night for these flash light pictures, Mr. McCollin recommended holding a candle just behind a veil of open crochet work. It was very easy to see the white meshes in the camera, and was quite an accurate method.

A New Transparent Film.—At the same meeting Mr. F. C. Beach exhibited a new flexible transparent film, explaining its various characteristics. It consisted of a sheet of insoluble bichromated gelatine exposed to light, then bleached with sulphurous acid and coated on one side with the sensitive emulsion. It can be exposed in the camera like a glass plate, developed, and fixed in the usual way, but is dried, after soaking in alcohol for fifteen minutes, by being placed between two sheets of blotting paper and wrapped around a paper cylinder not less than three inches in diameter.

After this it dries within a short time, perhaps half an hour. Negatives made on the film are grainless, quick printers, and no heavier than paper.

It is made in England under Froedman's patent.

Improved Pyro-Hydroxylamine Developer.—James H. Stebbins, Jr., of the Society of Amateur Photographers, advises the use of the following formula:

No. 1.

Hydroxylamine	2 grammes.
Pyrogallol	15 grammes.
Water (distilled preferred)	100 c. c.

No. 2.

Carbonate of soda (crystals)	24 grammes.
Sodium sulphite (crystals)	71 grammes.
Water	1,000 c. c.

To develop, take 65 c. c. of No. 2, and add thereto at first 2 c. c. of No. 1. When development is three-quarters advanced, add from 1 to 2 c. c., if it is seen more density is required. Thirteen plates may be developed with one solution. The color of the negatives is steel gray, and the shadows are remarkably transparent.

The developer is slower than when pyro alone is employed, but quicker than the hydro-quinone developers.

It is an excellent developer for lantern slides or transparencies. Does not stain the film in the least. Mr. Stebbins finds the hydroxylamine acts as a preserver of the pyro similar to sulphite of soda and, being a more stable salt, is probably more desirable.

Military Notes.

Now that Italy inclines to German alliances, the French are seeking new means of strengthening their eastern or Alpine frontier, and the French military press is urging more haste in the construction of the cordon of forts which the general staff is organizing along the giant hills that separate the republic from the kingdom of Italy. There was a time when Alpine snows were considered impassable, and Hannibal's bold feat of leading an army over them was the wonder of the age. Napoleon crossed with his army in 1800 over the pass of the Great St. Bernard, which is 7,963 feet above the plains below; and since then, the Alps have not been accounted as a safe barrier against invasion. Now there are as many as fourteen good roads over the various sections of the Alps—safe even for carriages; the most frequented being that of Mt. Cenis, built by Napoleon in 1805, 30 feet long and 18 feet wide. The French are now transporting heavy siege artillery to their new or remodeled works commanding the highways that lead to France, and so arranged as to be capable of "sweeping" them from two sides. *L'Avenir Militaire* calls attention to the fact that, if Italy is to be invaded, Briancon is the point from which the enterprise may the more readily be accomplished. This is the highest town in France—4,283 feet above the sea level. It commands the principal pass to the Italian and Swiss frontier, and has seven forts, protecting all approaches, with subterranean and connecting passages cut through the solid rock.

"Red tape" and the "Circumlocution Office" are getting a deal of severe criticism in both England and France. In the former country, Lord Charles Beresford, who recently resigned his office of Junior Lord of the Admiralty, has given as the reason that timely preparation cannot successfully cope with the red tape bureau, for that, when finally it gets clear, it is no longer timely, and he demands to know if the duty of the naval bureau is to keep the service disorganized, as at present, or to make it the effective force that the nation demands. In France there are complaints from all sides that a tediously prolix official formality serves to render the best exertions of the corps commanders unavailing. As in the English office, the officials—invariably the big ones—drowse over their work, postpone its expedition, or let it drag through one department after another, till finally, when it emerges, it is either too late for its purpose or has lost the only features that made it valuable.

A Russian naval officer has written a little book concerning Russia's probable action in the event of war with Great Britain, which, now that it is translated, is creating much comment in the English military journals. The author has, it is evident, informed himself as to the events of our civil war, especially regarding the effective work accomplished by the rebel corsairs Alabama, Georgia, and Florida, for it is in like manner he would prey upon the British mercantile marine. He refers, no doubt, to ships of the Vladimir type, which Russia is now building, when he says that, at the first lowering of the war cloud, Russia would dispatch fast, unarmored, light battered cruisers to various distant ports on the great commercial highways, and, being informed by cable at the earliest moment after war was declared, take the seas after British ships. He looks over the roll of British war ships, and finds not one among the number that could catch the Azov, which has made over 20 knots an hour in ordinary seas, and can do still better in smooth water, and pertinently inquires what Britain could do to prevent the loss of her commerce. He estimates that the Russian cruisers would take or burn seven British ships a day on the average for the first few months.

A French writer compares the French fleet with the Italian, and bitterly complains that, though spending 200 millions a year on her navy, against 60 millions by the Italians, the latter are quite as strong numerically and have more big armored ships (*cuirassés*). He doesn't say anything about speed, coal capacity, and the like, nor how often the eight great battle ships Italy keeps in the Mediterranean require repairing. Recent experience with the big ships of the British navy—and they are as good as any—shows that, in heavy weather, they are awkward, often to unmanageableness, and that it is hazardous to let them maneuver in company. The test of a ship now is What can she do? instead of How heavy are her sides and battery? Speed and coal-carrying capacity are considered first with expert naval authorities now.

The big British war ship Imperieuse, a ten gun cruiser of the first class, is now under inspection, being practically useless at sea because she won't mind her helm under steam, "and with any wind requires a great deal of weather helm, as much as two turns having been needed with a fresh breeze abeam."

The corps of mounted infantry (*chasseurs à pied*) has been reorganized by the French general staff, and now follows that admirable system of tactics which was devised by our General Sheridan. The underlying principle is to make the horseman a trooper as well as a foot soldier, and though fighting on foot is his vocation, and the horse a means of hurrying him along, yet on occasion to be able to dash on an exposed flank of the enemy with the same impetuosity and effectiveness as a regular trooper.

A Remarkable Naphtha Spring in Baku.

According to the *Engineering and Mining Journal*, one of the largest naphtha fountains yet known has lately broken out near Baku, which threatens to inundate all Balakhani. The naphtha, owing to the pressure of the gases which accompany it, rises to a height of from 280 to 420 feet, and is carried away by the wind to a great distance, falling like fine rain at the more distant parts of the district, but near the fountain coming down in torrents that form rivers and streamlets. Further on it falls like sleet, and settles in a layer on all the buildings in the neighborhood. These naphtha rivers flow for a distance of more than half a mile, and pass through wells, works, reservoirs, and inhabited houses, etc. Unfortunately, all the reservoirs in the neighborhood were full when the fountain broke out, and the oil was thus wasted. Owing to the stillness of the atmosphere, at one time the gases which accompany the naphtha spread in a heavy layer for more than 280 yards, filling the houses and placing their inhabitants in a most dangerous position, especially at night, when fires were lit. The sand and dust thrown up by the fountain form a hill of considerable size, and have buried the boiler house of the mining company's works and all buildings in close proximity to the fountain. There is no doubt that any exposed flame would set the whole district from the mining company's works to the Sabounchi railway station in a blaze. Many efforts have been made to stop the spring, but all have as yet proved unavailing, for after five or six hours the fountain would again burst forth with all its former vigor. For some days the fountain has been left to play without hindrance, and has increased in power. In consequence of a strong and changing wind setting in, the naphtha has been scattered in every direction, turning the whole district into a petroleum swamp. The naphtha pours from the roofs of the houses, on to which also fall the earth and stones carried up by the oil.

The Retirement of Prof. Maria Mitchell.

Miss Maria Mitchell, for many years Professor of Astronomy at Vassar College, Poughkeepsie, N. Y., and the first incumbent of that position, has resigned the professorship. For twenty-two years she has taught astronomy in that institution. She was born in Nantucket, Mass., Aug. 1, 1818, and there began her astronomical work at the age of eleven years, by assisting her father in observing a lunar eclipse. In 1847 she discovered a comet, and this made her fame, the King of Denmark giving her a gold medal in honor of the achievement. She has since added seven other comets to her list, being the first discoverer of all of them. She visited Europe shortly after 1847, and was there the guest of Sir John Herschel and Sir George Airy, then Astronomer Royal at Greenwich. She holds the degree of LL.D. from three institutions, the last being granted by Columbia College. She is one of the glories of Nantucket, the natives of that island being very proud of its distinguished daughter. Her resignation was prompted solely by a desire for rest, which was needed on account of her advanced age.

THE PERE LA CHAISE CREMATORY.

The Pere la Chaise crematory building, which was begun more than a year ago, is now half finished. The experiments that have recently been made in the presence of Messrs. Chassaing, vice-president of the municipal council, Leroux, division chief of the prefecture of the Seine, Formige, architect of the structure, and Schnell, architect, inspector of the work, are so conclusive that the municipal council of Paris can, without scruples, now vote the funds necessary to finish the funeral edifice.

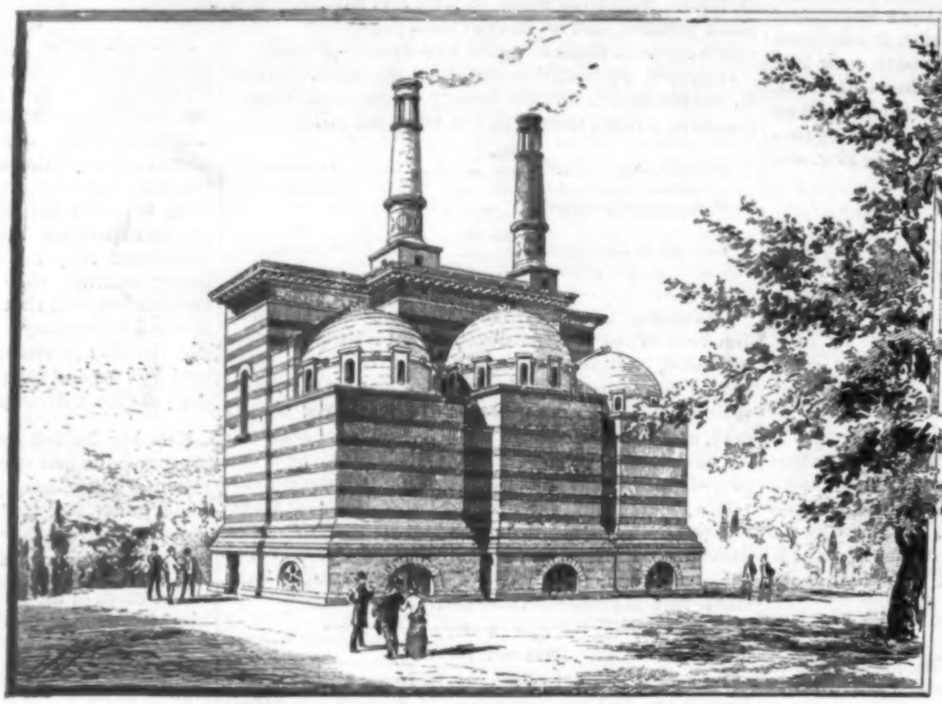


Fig. 1.—REAR VIEW OF THE PERE LA CHAISE CREMATORY.

The latter is situated in the northern part of the cemetery, in a line with the chapel, but much beyond, and also beyond the Israelite cemetery. Its present aspect is that of a massive parallelogram, with narrow openings here and there, and somewhat resembling a mosque. It rises above ground to the height of a third story, and is surmounted by two chimneys of white stone.

Only the back is finished. Above the crown of the entablature rise three domes—one might say three church chapels, but in reality they cover the crematory chambers, vaulted and groined halls each containing a furnace.

The front, which is unfinished, will be continued by a vast hall, whose interior will have nearly the aspect of a chapel. It is here that families, during the process of incineration, will congregate, either to listen to eulogies pronounced by orators on the deceased or to assist at the funeral ceremonies. This hall will be preceded by a vestibule. At first, only the crematory apparatus under the first dome to the left will be operated. This furnace, which is of the Gorini type, already in use at Milan, is not very complicated. Externally, its form is massive, and, on each side, the iron framework that supports the fire brick is so arranged as to receive a wooden frame covered with drapery and forming a bier. Externally, it is closed by four bronze doors, the inner pair of which contain a sight hole to permit the fireman to examine the operation. These doors are lined internally with fire brick.

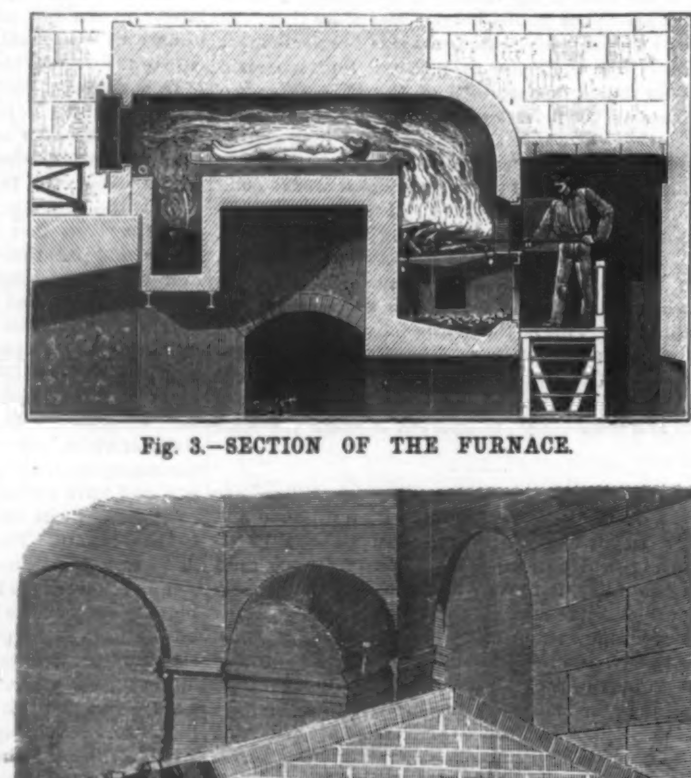


Fig. 3.—SECTION OF THE FURNACE.

One of our engravings shows a section of the furnace and the manner in which the cremating is effected. The body, brought to the doors on the carriage seen to the left, is placed upon a bronze plate provided with rollers that run upon rails. It is necessary to slide this plate over an empty space above the orifice of the draught chimney, shown by a white arrow in the cut. A double current of air created above the fireplace forces the flames to envelop the cadaver, which thus becomes quickly carbonized. The fuel used is beech wood.—*L'Illustration.*

Fig. 2.—THE FURNACE.

Sand Blasting.

The sand blast process is one that has been illustrated and described in these columns, and in other papers, but nowhere have we seen so clear an account of how it is done as we find in the Chicago *Herald.*

The machine suggests a cider mill in shape, or a cheese press. The glass is laid on rubber belts at the side, and is then fed into the machine. As soon as it disappears from view, some rubber flaps come down and prevent the pressure in the interior from escaping. This pressure is exerted by wind and sand—a 20 horse power engine being required to raise the "blow" which drives the sand to the glass. Looking through the window in the center of the machine, a "gun" is disclosed. It has a large mouth-shaped opening, at which it is loaded with 20 horse power ammunition of wind and sand. Before the ammunition is allowed to leave the gun, the aperture narrows to about one-sixth the width of the loading point. This condenses the sand so that when it leaves the gun it strikes the glass with such force as to eat into the surface. When the glass has been exposed, it passes out of the machine on rubber belts at the opposite side. This process is called grinding, and one machine will grind about 900 square feet in a day.

Now for the decorative part. Suppose the sand blaster wishes to present on a square of glass a certain design. He simply covers the surface with beeswax and a certain mixture laid on over the glass in exact duplicate of the design required. The glass passes into the machine. The sand is fired from the gun, but this time it grinds only the exposed parts. The portion covered with beeswax and the secret mixture is not touched by the sand, and when the plate emerges from the machine, and the wax, etc., are washed off, behold the design standing out in sharp contrast to the ground surface which the sand has scarified.

This is the A B C of sand blasting. The process is susceptible of much elaboration, and one improvement, which was patented last year by a Chicago gentleman, is called the "ammograph." The pictures are first drawn on the back of the glass by the artist with a color which will resist the action of the sand blast. It is then subjected to the stream of sand, which cuts the glass in all parts which are not covered more or less by the resistant. The resistant is then washed off clean, leaving the pictures cut into the glass. They are next silvered over, if desired, to give greater brilliancy. The effect is that of a multiplicity of colors, but no paint or coloring of any kind is used, the effect being obtained by the different shades of the glass itself.

How they Protect Telegraph Wires in Chili.

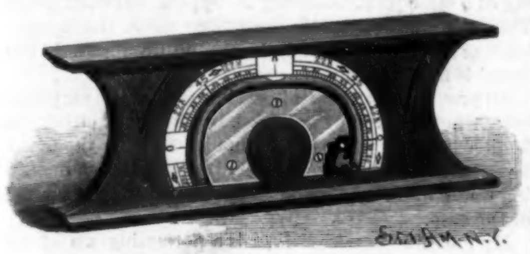
According to the *Electrical Review*, when the electrical telegraph was first introduced into Chili, a stratagem was resorted to in order to guard the posts and wires against damage on the part of the Araucanian Indians and maintain the connection between the strongholds on the frontier. There were at the time between forty and fifty captive Indians in the Chilian camp. General Pinto called them together, and pointing to the telegraph wires he said: "Do you see those wires?" "Yes, general." "Very good. I want you not to go near or touch them; for if you do, your hands will be held, and you will be unable to get away." The Indians smiled incredulously. Then the general made them each in succession take hold of the wires at both ends of an electric battery in full operation. After which he exclaimed: "I command you to let go the wire!" "I can't; my hands are benumbed," said the Indian. The battery was then stopped, and the man released. Not long afterward the general restored them to liberty, giving them strict injunctions to keep the secret, and not to betray it to their countrymen on any account. This had the desired effect, for as might be expected, the experiment was related "in the strictest confidence" to every man of the tribe, and the telegraph has ever since remained unmolested.

The Bucharest Spider.

The habits of a running spider of southern Europe, *Tarantula narbonensis*, Latr., studied by Herr Beck, are curious. It makes a vertical round hole in the ground about ten inches deep, and this, with a small earth wall sometimes made round the mouth, is lined with web. A little way down is a small lateral hole, into which the spider shrinks when an animal falls into the tube; when the animal has reached the bottom, the spider pounces on it. One can readily tell that a tube is tenanted, by the bright phosphorescent eyes of the spider turned upward. In fight the spider erects itself on its last pair of legs, striking with the others. The bite is not fatal to man, but it causes large swellings. The children in Bucharest angle for these spiders by means of an egg-like ball of kneaded yellow wax tied to a thread. This is lowered with jerks into the hole, and the spider fastens on it and can be pulled out; whereupon another thread is passed round one of the legs, and the animal is played with.

AN IMPROVED LEVEL AND INCLINOMETER.

A combined level and plumb, which may also be used to obtain any angle desired between a horizontal and a perpendicular line, is illustrated herewith, and has been patented by Mr. Enos F. St. John, of Highland Station, Mich. The tube used is formed with two quadrant sections, a straight central section, and a straight section at one side at right angles to the line of the central section. The opposite end of the tube has a small globe, connected with the main portion of the tube by a narrow neck. The tube is mounted in a suitable stock, in connection with a graduated plate shaped to fit close against the upper face of the tube. In ordinary use as a level or plumb a large air bulb is desirable, but when the instrument is to be used for obtaining angles, a smaller bubble is obtained by turning the instrument so that the main bubble of the tube may be brought into the small globe, in which there is always a bubble. The size of the bubble leaving the globe may be varied by turning the instrument quickly or slowly. The straight sections of the tube enable the operator to detect the slightest movement of the instrument, and, in



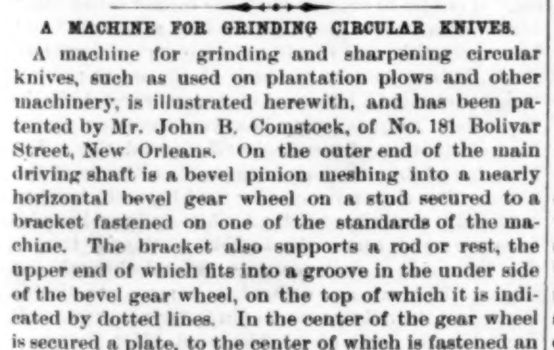
ST. JOHN'S SPIRIT LEVEL AND INCLINOMETER.

connection with the use of a small bubble, facilitate readily obtaining any angle from a perpendicular to a horizontal line.

AT a recent meeting of the council of the National Amalgamated Association of Iron and Steel Workers, held at Sheffield, England, the president, Mr. William Shaw, in opening the meeting, said that the council had been called together to consider a circular from the Labor Bureau, requesting certain information. The general secretary (Mr. E. Trow) said that the Board of Trade and Labor Bureau wanted to know too much of the private affairs of individuals and of associations. He believed in labor managing its own affairs, and objected to the government prying into the private affairs of individuals. After a full discussion it was unanimously resolved: "That no information with regard to the earnings and cost of living of the workmen connected with the trade, or concerning the affairs of the association, shall be supplied by the general secretary or any member of the association."

A MACHINE FOR GRINDING CIRCULAR KNIVES.

A machine for grinding and sharpening circular knives, such as used on plantation plows and other machinery, is illustrated herewith, and has been patented by Mr. John B. Comstock, of No. 181 Bolivar Street, New Orleans. On the outer end of the main driving shaft is a bevel pinion meshing into a nearly horizontal bevel gear wheel on a stud secured to a bracket fastened on one of the standards of the machine. The bracket also supports a rod or rest, the upper end of which fits into a groove in the under side of the bevel gear wheel, on the top of which it is indicated by dotted lines. In the center of the gear wheel is secured a plate, to the center of which is fastened an upwardly extending screw rod, on which screw cone-shaped nut collars adapted to hold the knife to be ground in place on the screw rod, so that the knife turns slowly with the bevel gear wheel when the main shaft is rotated. The rapidly moving grinding wheel shaft, carrying a wheel of emery or other suitable ma-



COMSTOCK'S GRINDING MACHINE.

terial, is operated by the large gear wheel, provided with a handle, through a pinion and small gear wheel. The grinding wheel shaft can be adjusted sidewise in its bearings, for bringing the wheel nearer to or farther from the center of the knife, and it can be placed at an angle to the knife, as desired, by a screw rod and spring controlling the bearing of the shaft in this end of the machine, the spindle carrying the knife also standing at an angle to permit of grinding a beveled edge.

[ANTHONY'S BULLETIN.]

The Pinhole Camera.

BY WM. A. PICKERING, HARVARD OBSERVATORY.

Having recently had occasion to take several photographs, using a pinhole as a substitute for a lens, I was much surprised at the distinctness of the images. The resulting negative is of course not as sharp, and a silver print from it would not look quite as well as if taken with a lens; but for bromides, where the detail required is not so great as for silver prints, very satisfactory results may be obtained. I have recently taken a number of photographs with pinholes of various sizes, and the following facts have been deduced: (1) The distance from the hole to the plate may be as short as desired, but should not exceed twelve inches. (2) The shorter the distance, the better the definition. (3) The size of the hole is regulated by the distance. For a distance of twelve inches, the best results are obtained with a hole measuring three one-hundredths of an inch in diameter. If smaller than this, the image is blurred by diffraction; if larger, the image is likewise blurred. But for most purposes where shorter foci are used, we may lay it down as a rule that the aperture should in no case exceed a fiftieth of an inch, nor be much less than one one-hundredth. As regards exposure, with one one-hundredth of an inch aperture, and a focus of three inches, on a sunny day with a rapid plate, one should give about ten seconds. So that, although the exposures are longer than with a lens, it will be seen that they are by no means excessive.

The pinhole may be made in a piece of black paper, or in a piece of thin sheet metal, which should afterward be thoroughly blackened. In either case the burr must be carefully removed. A simple method of avoiding the burr is to burn the hole in paper with a red hot needle.

The advantages of the pinhole camera are: (1) That doing without the lens, one saves weight and expense. (2) That one can take as wide an angle as the camera will admit of, say 120 degrees on the horizon against 80 to 85 degrees with a wide angle lens. (3) That all objects, near and far, will be in equally good focus. (4) That one may suit the size of the image to fit the plate without changing one's point of view. (5) That one may take a view, if necessary, directly toward the sun, as there is no trouble from fogging caused by the sun illuminating the surfaces of the lenses. Indeed, very satisfactory photographs may be secured showing the sun in the picture. In this case, however, the sun takes black instead of white, owing to the reversal caused by over-exposure. Finally, while not advising photographers to throw away their lenses and substitute pinholes, I wish to call their attention to the fact that the pinhole picture is not a thing to be wholly despised, and that there may occur circumstances under which the pinhole may prove a very useful auxiliary.

The pinhole principle may also be used for another purpose, more amusing, perhaps, than artistic, which was first suggested to me by Mr. J. R. Edmands. Let us substitute for the lens a narrow vertical slit, about three inches long by one-fiftieth of an inch wide, made by pasting two strips of black paper side by side. About two inches behind this arrange a horizontal slit of the same dimensions. Two inches behind this place the sensitive plate. The apparatus is analogous to two cylindrical lenses of different foci placed at right angles, but is more readily adjusted. If an exposure is now made, we shall find everything distorted to twice the size horizontally that it is vertically. By turning the camera on its side, we get a vertical distortion. By inclining the slits at different angles, variously distorted pictures may be obtained.

Cambridge, Mass.

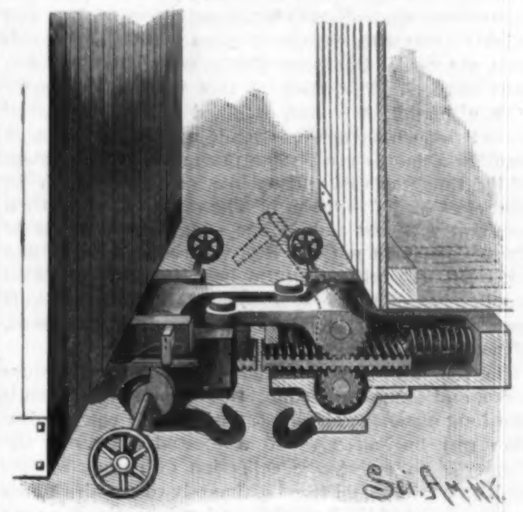
[Bromide prints sent by Professor Pickering fully illustrate all he says, more especially the various distortions by the slits.—EDITORS.]

Utopian Heating Arrangements.

The Utopian idea is entertained in some quarters that the house of the future will be constructed *sans* fireplaces, steam boilers and radiators, furnaces and ranges, and will give place to neither base burning magazine stoves, steel ranges, nor ordinary cooking and heating stoves. Skeptical persons will say this visionary theory is "all gas," and this conclusion would be literally correct, inasmuch as the forecast anticipates that gaseous vapor will ere many years be utilized almost universally, not only for domestic, but for manufacturing and commercial uses also. A recent device is to fill a brazier with chunks of colored glass, place several jets of gas beneath, when the glass, becoming heated, raises to a comfortable thermal condition a room 10×30 feet in dimensions. The heat is raised or lowered as desired by regulating the supply of gas, no smoke is given off, ventilation is had at the windows, and the artistic effect is produced by an arrangement of different colors in the glass chunks, black pieces representing fresh coal, red pieces assimilate a ruddy flame, yellowish white glass personates white heat, blue glass gives off the effect of a blue flame, and other colors and shades furnish the remaining colors of the spectrum.—*The American Artisan.*

AN IMPROVED CAR COUPLING.

An automatic car coupling, adapted to be uncoupled from either side of the car, has been patented by Mr. George F. Brown, of Constable Hook, Hudson County, N. J., and is illustrated herewith. In a central opening of the drawhead is held to slide longitudinally a rack, having teeth on the top and bottom, the upper teeth meshing into a segmental gear wheel from which extends an arm, in the outer end of which is loosely held a coupling pin, adapted to engage the cross piece



BROWN'S CAR COUPLING.

on the other drawhead. The under set of teeth on the rack mesh into a gear wheel on a shaft on which is fastened a hand wheel at the side of the car, there being also a ratchet wheel on the same shaft engaged by a pawl. When two cars are to be coupled, the operator releases the pawl and turns the hand wheel to slide forward the rack, thereby swinging upward the arm carrying the coupling pin, as shown in dotted lines in the sectional view. As the cars come together, the front projecting ends of the racks strike against each other and are forced inward, the arms with the coupling pins swinging downward, and the pins engaging the cross pieces in the front end of each drawhead, in which position the device is locked by the pawl and ratchet wheel at the side of the car. On the under side of each drawhead is a hook by which cars can be coupled by a common coupling hook.

A PORTABLE VAPOR AND HOT AIR BATH APPARATUS.

A portable device for sustaining and keeping from the shoulders a canvas or rubber covering, under which, in connection with a suitable lamp or stove, a bath may be administered, is shown in the accompanying illustration, and has been patented by Josephine G. Davis, M.D., of No. 18 East Eleventh Street, New York City. It consists of two vertical supports, preferably of brass or galvanized iron, with suitable slots in their lower ends to pass over the rail of a chair, to which they are

A PORTABLE BATH APPARATUS.

fastened by thumb screws, and also with slots in their upper ends to receive horizontal rails. The latter consist of two pieces of metal fastened together and folding upon a rivet when not in use, and two extension pieces running in grooves in the rails, the whole made to extend in the form of a circle over the chair and just above the shoulders of the patient. A waterproof covering reaches from the neck to the floor, being open at the front and fastened by buttons or loops, and in connection with this covering is used an inner cape, coming in contact with the patient and protecting him from contact with the metal supports. A lamp or stove is placed beneath the chair for generating steam or hot air.

A REHEARING in the driven well patent has been refused, and the Supreme Court has affirmed its previous decision, that the patent granted to Green was invalid.

THE ELECTRIC CLUB.

(*Continued from first page.*)

rooms. These wires are used for the most varied and different purposes. The introduction of so extensive a system of wires involved a complete overhauling of the building, and this work, in connection with the decorative and other operations, involved an expenditure, it is said, of some $40,000. In the basement are the billiard rooms and kitchen, and on the main floor are situated the parlors and restaurant. These, like the rest of the building, are lighted by electricity; for the principal apartments electroliers in brass and silver bronze, and thickly hung with strings of glass prisms and pendants, are used. Cut glass shades cover the incandescent burners. The effect of this work is extremely rich, although, of course, obtained at the sacrifice of some light, which again is made up for by the large number of lamps used. The perfection of the system of lighting was very perceptible on the occasion of the evening of opening. The parlors were then crowded with the assemblage of guests listening to Prof. Rowland's paper. Had the room been lighted with gas as brilliantly, the heat thereby produced would have made it very uncomfortable for all. As it was, the air of the room was perfectly pleasant, although it was flooded with light.

On the next floor are situated the library, lecture room, and committee room. In the committee room is the long distance telephone, with which communication can be had with all connected cities. In the library is an embryonic collection of patent reports and other works, destined ultimately to acquire much value. A set of the French *brevets d'invention* is a very valuable portion of this collection. The lecture room is situated on the rear of this floor. It has at its end a large stage for the accommodation of the speaker, and in a corner back of the stage the electric leads are introduced. Immediately above the lecture table a large wooden panel is attached to the ceiling. This is for the purpose of serving as a place of attachment for wires and any special apparatus that may be in use during the lecture. The wooden surface offers every facility for the attachment of hooks, staples and insulators. In the upper floors some rooms are reserved for sleeping apartments and other purposes.

Scattered throughout the building will be found various objects of intertest, as illustrating the progress of the science. The electric stove, in which a current of electricity is used to heat a long platinum wire, carried zigzag across a surface of asbestos, and above which wire is arranged the heating plate, is illustrated among our cuts. A machine for blacking boots, consisting of a motor that rotates a flexible shaft, to the end of which shaft is attached a rotating brush, is kept ready for use in the basement. The brush is provided with a clutch, so that it may be thrown in and out of gear with the rotating shaft, and thus stopped or started without interfering with the motor. A switch is also provided for stopping the motor. A safe with electric lock is used to hold the valuables of the club. An electric door opener for the main entrance is employed. The initiated member who wishes to enter the building presses with his foot a block, upon which the door immediately flies open. In this way electricity is made to contribute its fullest part to the conveniences of the building.

All the appurtenances of a social club are of course provided, including billiard and pool tables and other features. The walls are hung with paintings and photographs, among which are included many very interesting portraits of electricians.

The objects of the club are not purely social. President Davis, in his address at the opening, summarized them briefly and concisely. The hope is that the club will have a true work to do in furthering the progress of electrical science and its rapidly increasing application to the commercial interest of the world. It is designed to have the club supply the useful functions at once of a museum, a laboratory, a lecture room, and a library. For the use of lecturers, apparatus is to be supplied which, in connection with the large generating and storage plant, will give unusual facilities for work on a large scale. It is proposed to have lectures given by the most distinguished scientists periodically during the season. This idea was happily carried out at the opening in the selection of so eminent a physicist as Prof. H. A. Rowland. The laboratory project remains to be carried out. In Philadelphia, the Franklin Institute performs for all mechanical subjects a most useful work in conducting investigations into the machinery and technical processes. It also has an annual course of lectures on technology. The work of the Electric Club, it is hoped, will be of an analogous nature. President Davis summarized the ambition of the club's founders in his aspirations that the Electric Club might be to electrical matters what the Cooper Institute and the American Institute, of this city, and the Franklin Institute, of Philadelphia, are to mechanics.

Its constitution and by-laws are conceived in a spirit of simplicity and liberality. The institution is incorporated under the laws of the State of New York. It admits any duly elected person to membership, either as resident, non-resident, or life member. Provisions are made for change of class of membership. The president of the club is Mr. Henry C. Davis. Its vice-presidents include Messrs. Geo. W. Hebard, Thomas A. Edison, John B. Powell, Geo. L. Beetle. Secretary, Chas. W. Price. Treasurer, A. J. Dam. The committee on membership consists of Messrs. Henry Hine, Geo. T. Manson, Geo. Worthington, Henry D. Lyman, Lieutenant, F. W. Toppan, U.S.N.

The Metallic Cartridge System of Breech-loaders.

George W. Morse, the inventor, says: I invented the modern metallic cartridge system of breech-loading firearms, now in use in all parts of the world in the form of infantry rifles, repeating firearms, and in all machine guns, in 1855; patented it in 1856 and 1858, introduced it into the service of the U. S. army, by manufacturing the Springfield rifle musket and other arms at the Springfield Armory in 1858 to 1860. I then reduced the caliber of new carbines from 0·58 to 0·45 caliber. I sent my new arms all over Europe, readily firing twelve shots per minute—no misfires—and the cartridges always automatically extracted by opening the gun, substantially as it is now done in all the military arms in the world.

A West Point ordnance board, convened in 1858, required by an order of the Secretary of War to select from twenty-three or four models then on trial "at that place on the 12th instant, and report on the adaptability of the principle of each in the alteration of the muzzle-loading to breech-loading arms," say in conclusion:

"The board selects Morse's model, inasmuch as it differs from the others by including the new and untried principle of a primed metallic cartridge, which may on actual trial be found of advantage."

My own were the only military arms in the world at that time which used the primed, flanged, expansive metallic cartridge loaded as a whole, and leaving a clean cartridge chamber in the gun when opened to receive a new load.

My agent in England was met by the following report of a committee, dated Hythe, September 23, 1858:

"The cartridge, which is metallic, is a self-primer. . . . The introduction of fulminating powders into cartridges is a dangerous element in their construction, and for military service an insuperable objection. The manufacture, the packing and carriage, become alike dangerous, and these alone the committee consider are sufficient reasons for condemning the employment of cartridges with caps attached." This report positively knocked the whole system out, for it was useless without the primed cartridge. The objections of our own army officials to breech-loaders were so invincible that it seemed absolutely impossible to make headway against them.

Fearing the success of my plans, they procured the passage of a clause in the army appropriation bill of 1860 forbidding the purchase of patents and patented articles.

But in 1866 the civilian Secretary of War, Stanton, appreciating the advantages of breech-loaders, ordered the alteration of 25,000 "Springfield muskets to breech-loaders of the best pattern."

Then it was that Master Armorer Allin, to whom I had devoted the years from 1858 to 1861, at the Springfield Armory, teaching how to make my guns, began the work, and made the Allin alteration of the Springfield musket, retaining every one of the essential elements of my inventions patented in 1858 and 1859.

These essential elements, as disclosed in my patents in combination, are as follows, and I defy the world to show its existence previous to 1856, or to produce a military arm of any kind, except revolvers, now in use in any army in the world, in which the combination is not used:

First.—A barrel rigidly attached to the stock or frame open at the breech, having a tapering cartridge chamber to admit a cartridge case whose interior diameter is equal to the diameter of a projectile large enough to fill the rifle grooves in the barrel, the rear end of the barrel cut away for the hook or bill of a cartridge extractor to come in front of the flange of an inserted cartridge, and fill the cut thus made to receive it, when the gun is fired.

Second.—A breech block movable in relation to the stock and barrel, which is locked in place before the charge is fired, and which carries an easily retreating firing pin, so that the cartridge can be forced in without pressure on the priming, or makes other provision for igniting the fulminate priming in the cartridge.

Third.—An open space non-contact, all around between the front face of the breech block and the rear end of the side walls of the cartridge chamber, leaving room between the face of the breech block and the rear end of the barrel for the head on any cartridge case made for use in the gun.

Fourth.—A loosely fitting, primed, flanged, expansive metallic case cartridge, capable of use any side up, which seals the breech joint, both as to powder and priming, and is made of sufficient substance not to burst and leak at the breech joint.

Fifth.—An automatic cartridge extractor, made movable in relation to the breech block and other parts of the gun.

The first one of these elements is often modified in machine guns to bring up different barrels, to prevent the overheating of one, but the principle always remains the same.

Some inventors move the breech block in one direction to open the gun, while others move it in other directions, but it is always the same breech block that gives the finishing thrust to insert the cartridge, never itself making contact with the barrel, always leaving an open space for a cartridge head, and always locked in place before firing, and always providing for firing the charge through itself, as described in my patents of 1856 and 1858, operated by me in two different directions.

All use a loosely fitting metallic case cartridge having the essential elements first described in combination in my cartridge patent of 1856, and claimed in my gun patent of the same date, to seal a breech joint purposely made open, between a movable breech block and the rear end of the gun barrel, but not essential to the sealing of a close joint necessary in tipping barreled guns. This combination in the cartridge made the breech-loading system possible, and not a military gun in the world is fired without its use.

All provide for the certain withdrawal of the cartridge case, whether fired or not fired, by the use of either the hook extractor patented by me in 1856, or the crank lever extractor described in my patent of 1858, operating upon an unchangeable flanged head on the rear end of the case.

My movable base cartridge is a perfecting up of my old system to the long-range small-bored rifles now in use. It provides for the inaccurate workmanship of both gun and cartridge, and also for the wear of parts of the gun in use by relieving the cartridge case from all longitudinal strain.

Its general adoption may be delayed for a time by ill-considered reports from the army, where my instructions for its use were not followed; but its final adoption is certain, because when properly handled it never clogs the gun, and becauses it reduces the cost of practice to learn the use of the gun substantially to the cost of powder, balls, and priming—a saving in our little army of about $30,000 yearly.

Canals or Ship Railways.

The system of carrying burdens on ship wagons is receiving attention, and, it is argued, if a vessel can safely carry a heavy freight over stormy seas, where half her hull is sometimes out of water, pounded by the waves that break upon her decks or drive upon her abeam, tossing her in their fury from crest to crest, and dropping her suddenly into great "troughs of the sea," it is idle to suppose that she cannot safely carry her burden when lifted gently into a "cradle," and borne smoothly and steadily along over solid rails of steel. It is customary to speak of the sea as a ship's "native element," but no ship was ever yet built in the water. Ship railways, however, have now passed beyond the stage of mere scientific speculation. The air is full of ship railway projects for all parts of the globe. The ship railway over the Chignecto isthmus is already under contract. A ship railway has also been surveyed across the Florida peninsula to save the 600 miles of distance around and through the straits. This, we are assured, is a most practicable route, and the railway can be built for about one-half the estimated cost of a ship canal. But the great work in all this programme, both as to the magnitude of its construction and its results, is the Tehuantepec ship railway of Captain Eads, now in the hands of Captain E. L. Corthell as chief engineer. This is a scheme which is regarded by competent judges as sound and well planned, though it is one of remarkable originality and boldness.

Perhaps it is too much as yet to say that the age of ship canals is giving way to that of ship railways, but M. De Lesseps can hardly be expected to feel quite at his ease in the presence of this new and vigorous movement.—*The Iron and Steel Trades Journal, London.*

Triple Expansion.

An interesting example of the value of triple expansion engines as compared with compound was exhibited on the Clyde, on the trial of the Orient liner Cuzco, which has recently been thoroughly renovated, and furnished with new boilers working to a pressure of 150 pounds to the square inch, and with triple expansion engines of the most approved type. The Cuzco is seventeen years old, and has hitherto been regarded as a 12½ knot boat. Recently she was tried on the measured mile for a six hours' run, when she attained a speed of 16 knots, and made upward of 75 revolutions per minute. This increase in speed was, a daily newspaper correspondent says, accompanied with the usual economy in coal consumption, and the incident is remarkable on account of the success with which the power of the new engines has developed a high speed in a vessel, the model of which is comparatively obsolete.

Correspondence.

A Blowing Well.

To the Editor of the Scientific American:

We have in our town a rather strange phenomenon. It is a bored well 120 ft. in depth, and about 5½ in. diameter inside the curbing, from which, just before a rain, a strong current of air issues. The current is sufficiently strong to blow a harmonica or toy spinning top so as to be heard 200 or 300 yards. It is only very strong just before a rain.

We would like to know what is the cause of the air blowing out so forcibly. The owner says he has examined the walls of it carefully with a mirror, and found no outlet from it. C. P. WADLEY.

Looxahoma, Miss., February 8, 1888.

Remedy for Ivy Poisoning.

To the Editor of the Scientific American:

The best of all remedies for poison ivy is simply hot water. All other remedies that I have tried (and I have tried many of them) only aggravate the poison, but hot water, as hot as can be borne, affords instant relief. It must be applied every hour or two, or as often as the itching returns. In a couple of days a cure is effected. Poison sumac yields to the same treatment. The inflammation, and with it the itching and burning, are allayed at once. I am poisoned dozens of times every year, but suffer no inconvenience except the trouble of applying the hot water.

JOHN BURROUGHS.

West Park, New York, February 16, 1888.

Self-Winding Clocks.

To the Editor of the Scientific American:

In your issue of February 4, page 75, Notes and Queries, No. 38, you give an emphatic "No" to subscriber's question.

In Watertown, Jefferson County, New York, Mr. Oliver Hitchcock has a clock that has been running now for over 20 years, and no doubt will continue to run until it is worn out. There is no addition to the original power, said power being a contrivance in the chimney, run by the ascending current of air. The air in circulating drives a fan, and the fan keeps the clock constantly wound. Does this not fill subscriber's bill? CANUCK.

Garden Island, Ontario, Canada.

[This does not "fill subscriber's bill." In the query (No. 38) referred to, no addition to original power was to be allowed. The ascending current of air in the chimney is continually adding to the original power in the case you cite. The "original power" of query No. 38 is the power originally expended in winding.—ED.]

The Swenson Sorghum Sugar Patent.

To the Editor of the Scientific American:

We, the undersigned, have read in your valuable paper the articles regarding a patent granted to Prof. Swenson for a device for neutralizing the acids in sorghum juice by the use of lime. We know that Capt. W. C. Tilton, of this county, produced the same effect in September, 1868.

The juice was run into tanks from the mill, and was treated with lime water to neutralize the acids present, testing with litmus paper. He succeeded in making a good, merchantable brown sugar, but he did not push it any further, as he said the amount of sorghum produced here did not warrant him in putting up works large enough to make it profitable, owing to the low price of sugar.

S. G. CARTER,
JAMES C. HENRY,
J. T. HENRY,
W. H. RAMSEY,
R. E. WILSON, *Atty.*,
JAS. M. MCGEE.

Spring Place, Murray County, Ga., Feb. 11, 1888.

[We stated the claim in the Swenson patent was for mixing lime with the cane chips in the diffusion bath, not for the broad or general idea of neutralizing the expressed juice by treatment with lime, which latter is very old, and we believe dates further back than Capt. Tilton's experiment.—EDS.]

Concerning Alum Baking Powders.

To the Editor of the Scientific American:

In your issue of February 4, 1888, in answer to "S" (query 23, page 75), who asks for certain information concerning baking powders, you say "alum is considered injurious."

It seems to me that this statement may produce upon the minds of some of the readers of your valuable journal an impression you did not intend. Moreover, if allowed to pass without comment, it might disturb, unnecessarily, many who use the so-called "alum" baking powders in preference to all others; for though by some persons "alum is considered injurious," others, who stand in the foremost rank among scientific men and practical chemists, declare that the use of alum in baking powders is quite harmless.

That distinguished chemist and author, Francis Sutton, F.C.I., F.C.S., etc., of England, is among the latter. He was engaged as an expert in a suit brought against the makers of the "Norfolk Baking Powder," an "alum" baking powder. This led him to make a series of experiments with this baking powder upon animals. When called for his evidence in court, after having given a full account of his experiments, he concluded with these words: "In my opinion there is nothing injurious in the use of this (alum) baking powder. It is perfectly harmless." (See article on Baking Powder in *Pharmaceutical Record*, April 1, 1887.)

But we need not go to England for proof that a properly made alum baking powder is not injurious to health.

In SCIENTIFIC AMERICAN SUPPLEMENT, No. 185, Prof. G. E. Patrick, professor of chemistry in the University of Kansas, gives his results of two months' experiment with alum baking powder upon animals. He concluded his article as follows: "It seems to me established, as well by experiment as by reason, that a properly made alum baking powder as used in making bread or biscuits is perfectly harmless to the human system."

In conclusion, permit me to suggest that the unfounded prejudice entertained by some against so-called "alum" baking powder is an inheritance from a by-gone generation, when "potash" alum was used to "improve" the quality of bad flour.

But "potash" alum used to improve bad flour is *one* thing, while burnt "ammonia" alum mixed with bicarbonate of soda, to raise bread or biscuit from good flour, is quite another thing, for burnt ammonia alum mixed with the proper quantity of bicarbonate of soda is *completely destroyed* during the baking of bread. The result is only small portions of Glauber's salt and still smaller portions of harmless hydrate of alumina.

JOEL G. CLEMMER.

Lansdale, Pa.

Isinglass.

Isinglass consists of the dried swimming bladder of different fishes. The bladders vary much in shape, according to their origin, and they are prepared for the market in various ways. Some are simply dried while slightly distended, forming pipe isinglass. When there are natural openings in these tubes, they are called purses. When the swimming bladders are slit open, flattened, and dried, they are known as leaf isinglass. Other things being equal, the value of a sample is determined by the amount of impurities present. These impurities are ordinary dirt, mucus naturally present inside the bladder, technically called grease, and blood stains. If the bladders were hung up to dry with the orifice downward, the mucus could be drained off; but usually the fishermen fear the reduction in weight, and take care to retain all they can. It is necessary to insist on having the bladders slit up and rinsed clean as soon as they are removed from the fish. This would so much increase the value of the product that the extra labor would be very profitable. Blood stains cannot be removed without injuring the quality. If any process could be devised effectual for this purpose, a valuable discovery would be made. The chief places of production are Russia, Siberia, and Hudson's Bay, Brazil, West Indies, Penang, Bombay, Manila, this being approximately the order of their importance. All Russian and Siberian is known as Russian, the more frequent varieties being "Beluga leaf," the finest in the market, obtained from a species of sturgeon; Astrakhan leaf; Saliansky leaf and book; and Samovy leaf and book. The fish yielding them inhabit the great rivers and fresh water lakes. They are caught during the winter, and the bladders removed and dried in various forms. The winter catch is collected at the great fair at Nijni-Novgorod, and is there bought by brokers and merchants from St. Petersburg. Some trade is done in Hamburg, but the varieties there sold are not what we know as Russian. When the ice breaks up, the isinglass is shipped by steamer as quickly as possible, mostly to the London docks, on account of the isinglass merchants there. The end of June and the beginning of July is the season when the winter's produce reaches this country. The Brazil, Penang, Bombay, and Manila products are imported at all periods of the year, generally packed in cases, varying in weight. Original cases of Penang isinglass weigh 3 cwt.; Manila, about 2 cwt.; Brazilian, about 2 cwt. 3 qrs.

The uses of isinglass are not very varied. The largest quantity is used by brewers and wine merchants for clarifying their goods. This property is extraordinary, for gelatin, which seems chemically the same thing as isinglass, does not possess it. One theory is that the tenacious mucilage shaken with the liquid gradually settles to the bottom, entangling all floating particles as it sinks. Another suggestion is that a very delicate fibrous network remains after the isinglass is dissolved, and entangles the particles in the way the mucilage is supposed to act. Many varieties of isinglass, generally the lower brands, are used for this purpose. Some brewers use it in the natural state, others prefer it manufactured into a fine or wide strip, which dissolves quicker, and suffers no waste. At present, Penang is the favorite kind. Russian long staple isinglass is used only by the Worcestershire farmers for clarifying their cider. In spite of its costliness, Scotch brewers prefer Russian leaf. The use of Samovy isinglass was formerly universal among the Irish brewers, and much is still sent to Dublin; but other varieties have partly taken its place. It is a Russian kind, obtained from the bladders of the *som* fish. Its name is the adjective form of the noun *som*. It is used only by brewers. Russian isinglass is also shipped to Madeira for use in clarifying wines. A good deal of various kinds is used in this country by wine merchants.

For clarifying purposes the isinglass is "cut" or dissolved in acid, sulphurous acid being used by brewers, as it tends to preserve the beer. When reduced to the right consistence, a little is placed in each cask before sending it out for consumption. Sole skins are the only substitute used for isinglass. They can only be had in winter, the supply is uncertain, and they have not the strength of the Penang varieties. Next to the brewer's demand comes that of the cook, who uses it for making jellies, thickening soup, and stiffening jams. For this purpose best Russian takes the highest position, owing to the superior strength and nourishing properties. Isinglass being the purest natural form of gelatin, a very pure article, artificially prepared without the use of acids or other chemicals, has long been known in the market as patent isinglass. It does not possess the clarifying power of the natural article, but is equally useful for cooking.

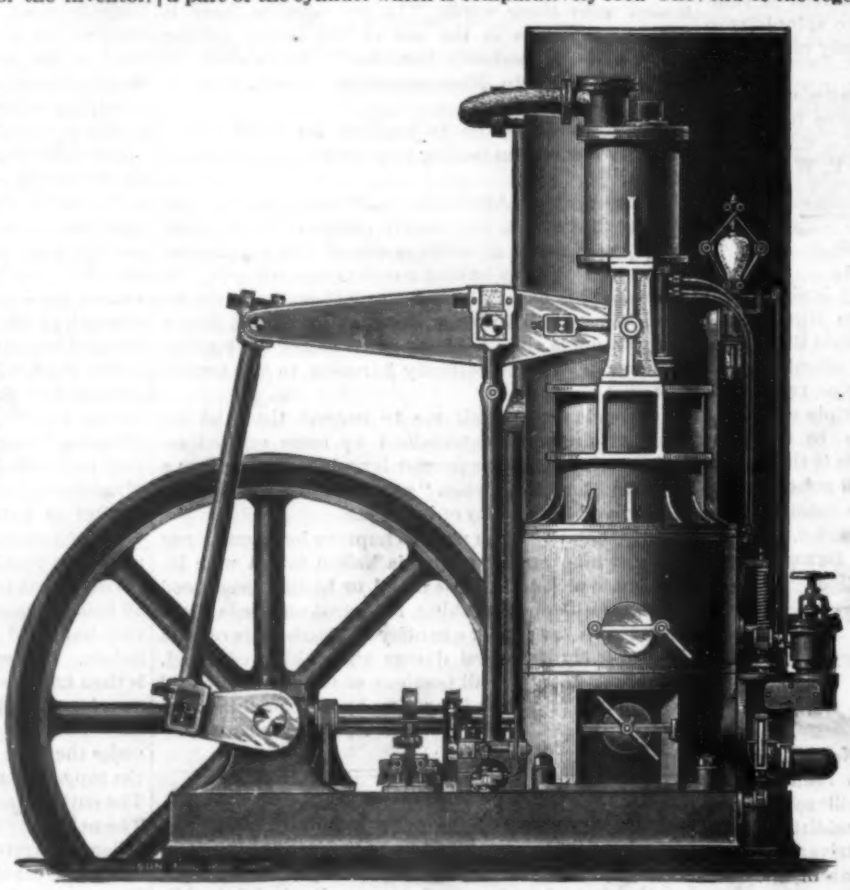
There seem to be only six isinglass cutters in England, all being domiciled in London. The sorted isinglass is very hard and tough, very difficult to bend or manipulate. It is soaked till it becomes a little pliable, and is then trimmed. Sometimes it is just pressed by hand on a board with a rounded surface, at others it is run once between strong rollers to flatten it a little, and make the dark and dirty spots accessible to the knife, the top of the roller being used to bend the pieces on. The cuttings are sold separately as an inferior grade. The next process is that of rolling. Very hard steel rollers, powerful and accurately adjusted, are used. They are capable of exerting a pressure of 100 tons. Two are employed, the first to bring the isinglass to a uniform thickness, and the smaller ones, kept cool by a current of water running through them, to reduce it to little more than the thickness of writing paper. It is very curious to see the thick, tough pieces gradually spreading out under the rollers, and folded and rolled like puff pastry till the separate pieces so unite that no joint can be seen, and the mass is reduced, under the coarse rollers, to what looks like semi-transparent millboard. From the finer rollers it comes in a beautifully transparent ribbon, many yards to the pound, "shot" like watered silk, in parallel lines about an inch broad. It is now hung up to dry in a separate room, the drying being an operation of considerable nicety. When sufficiently dried, it is stored till wanted for cutting, or it is sold as ribbon isinglass to all who prefer this form.

The machines for cutting are well and accurately made, and are so adjusted that they slice pieces off a sheet of paper without stirring or bending it in the least. For the "fine cut" isinglass in which chemists are interested, these machines are run at great speed, 2,000 to 2,500 revolutions, making 10,000 to 12,000 cuts in a minute. It takes an hour to cut 5 lb. or 6 lb., so that each pound would contain 100,000 to 125,000 separate fibers if none of them was broken. The actual number must be very much greater.—*Watson Smith, Jour. Soc. Chem. Industry.*

H. M. WILLIAMS recently visited Chicago after his return from the Asiatic empires, where he went to introduce the electric light, and he says to a reporter of the Chicago *Herald* that the readiness with which the Orientals adopt these improvements is quite astonishing. In Japan, most of the principal cities are now lighted by electricity, as ours are, and most of the finest houses are illuminated in the same way. A large plant has recently been placed in the palace of the Mikado, at Tokio, a very large building, or rather a cluster of buildings, connected by corridors and covering several acres. The Chinese do not take hold of these improvements as readily as the Japs, but are beginning to see their advantages. The Coreans are ready to adopt all modern ideas, particularly if they come from the United States. The palace of the King of Corea has a plant of 300 lights, and was first illuminated on the birthday of the king's mother-in-law, on the twentieth of February, with great ceremony. The palace is at Seoul, and consists of a series of long, low wooden buildings, with a thatched roof. As no foreigner is allowed to look upon the features of the king or queen, the workmen took great risks when they were putting in the apparatus, for if they had, even by accident, seen the face of the king, they would have been put to death, according to the custom of the country. They were carried into the palace and through the corridors in palanquins, and trumpeters were sent ahead of them, so that the royal family might keep out of their way.

THE HARGREAVES THERMO-MOTOR.

This remarkable engine, the invention of Mr. James Hargreaves, of the firm of Hargreaves & Robinson, Widnes, is the result of a series of laborious and costly experiments, extending over a period of six years. The difficulties and discouragements encountered were both serious and numerous, but have at length been overcome by the determined perseverance of the inventor. The present engine is the third constructed under these patents, the two previous engines being entirely for experimental purposes. At 100 revolutions per minute it indicates 40 horse power, and consumes two gallons of coal tar per hour, or about 20·5 lb., or 0·512 lb. per indicated horse power per hour, the cost of two gallons of coal tar being less than 3d.



THE HARGREAVES THERMO-MOTOR.

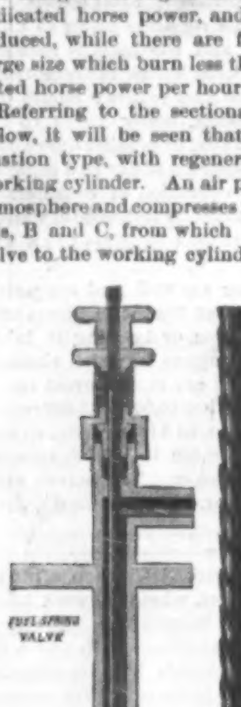
If we now examine the principle of the engine, we shall see how this extremely low consumption of fuel is attained. In 1824 Sadi Carnot propounded the great principle that the efficiency of any heat engine depended on the difference between the highest and the lowest limit of temperature in the working fluid, and that this difference must be as great as possible in order to secure a high efficiency. In the Hargreaves engine the highest temperature is probably over 2,461 deg. absolute, and the lowest 661 deg. absolute, or 2,000 deg., and 200 deg. Fah. on the ordinary scale, giving $\frac{2,461 - 661}{2,461} = 0·73$ as the highest theoretical available efficiency of the working fluid. If we compare this with a steam engine working with a boiler pressure of 170 lb. absolute and a terminal pressure of 6 lb. absolute, we have 830 deg. and 631 deg. as the highest and lowest absolute temperature, giving $\frac{830 - 631}{830} = 0·24$ as the highest theoretical efficiency of the working fluid in the cylinders. The efficiency of the boiler not being more than 0·7, we have $0·24 \times 0·7 = 0·168$ as the theoretical efficiency of the whole machine. In practice, the Hargreaves engine burns 0·512 lb. of coal tar per indicated horse power, and this may be still further reduced, while there are few steam engines even of large size which burn less than 1·6 lb. of coal per indicated horse power per hour.

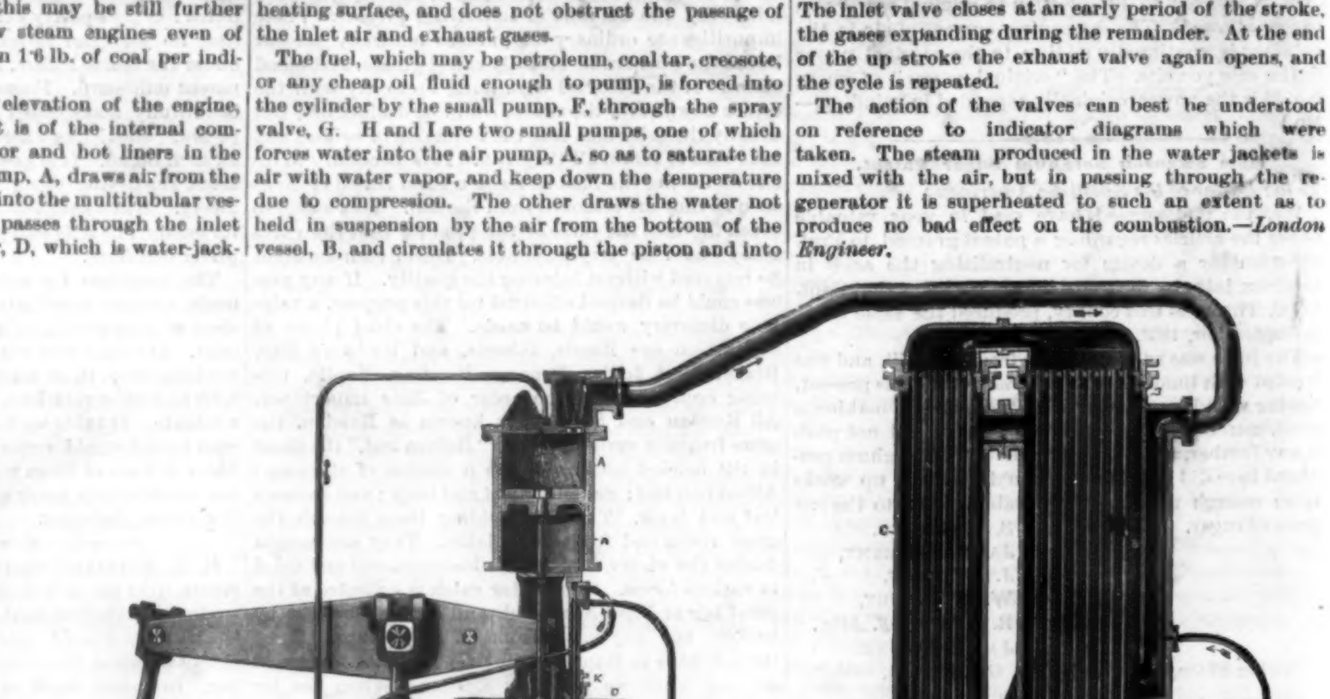
Referring to the sectional elevation of the engine, below, it will be seen that it is of the internal combustion type, with regenerator and hot liners in the working cylinder. An air pump, A, draws air from the atmosphere and compresses it into the multitubular vessels, B and C, from which it passes through the inlet valve to the working cylinder, D, which is water-jacketed at the lower end, and fitted with cast iron liners where exposed to the hot gases. A thin layer of non-conducting material is interposed between the hot liners and the surface of the water jacketed parts. The piston is also water-jacketed, and the bottom is fitted with a liner in the same way as the cylinder. The packing rings are at the top of the piston, and work in a part of the cylinder which is comparatively cool. The regenerator, E, is filled with thin rods of hard porcelain, having three deep spiral grooves in each, something like a twist drill. This arrangement gives a large heating surface, and does not obstruct the passage of the inlet air and exhaust gases.

The fuel, which may be petroleum, coal tar, creosote, or any cheap oil fluid enough to pump, is forced into the cylinder by the small pump, F, through the spray valve, G. H and I are two small pumps, one of which forces water into the air pump, A, so as to saturate the air with water vapor, and keep down the temperature due to compression. The other draws the water not held in suspension by the air from the bottom of the vessel, B, and circulates it through the piston and into the cylinder water jacket by the telescopic pipe, K. L is a small pumping engine used to pump up the air pressure in the vessels, B and C, before starting the engine, steam being supplied by the small boiler, M, which also serves as a separator for the steam produced in the water jackets, which steam is passed into the vessel, C, and mixed with the air. Before starting the engine the end of the regenerator and the passage leading into the cylinder (the passage being formed of hard fire brick) is raised to a full red heat by a small portable furnace, an opening with a suitable cover being provided for this purpose in the bottom of the cylinder.

The action of the engine is as follows: The piston being at the end of its upward stroke, the exhaust valve opens, the gases then in the cylinder at a very high temperature pass through the regenerator as the piston descends, and communicate heat to the material with which it is filled, the end of the regenerator next the cylinder being kept at a bright red heat, while the gases escape through the exhaust valve at 360 deg. Fah. The exhaust gases then traverse the tubes of the vessels, C and B, communicating heat to the air from the air pump, A, and escape to the atmosphere at about 180 deg. to 200 deg. Fah. The air from the pump, A, enters the bottom of the vessel, B, at 140 deg. Fah., being saturated with water vapor. As the piston approaches the end of the down stroke, the exhaust valve closes. At this moment the fuel pump, F, makes its stroke, being worked by a cam, injecting the oil through the spray valve, the oil falling on the hot fire brick, and the hot liners of the cylinder and piston bottom is evaporated and heated sufficiently to take fire as soon as air is admitted by the inlet valve. The air leaves the vessel, C, at 240 deg. Fah., and in passing through the regenerator it absorbs the heat left there by the exhaust from the previous stroke. It arrives in the cylinder at a very high temperature. The combustion is consequently remarkably perfect and intense. The inlet valve closes at an early period of the stroke, the gases expanding during the remainder. At the end of the up stroke the exhaust valve again opens, and the cycle is repeated.

The action of the valves can best be understood on reference to indicator diagrams which were taken. The steam produced in the water jackets is mixed with the air, but in passing through the regenerator it is superheated to such an extent as to produce no bad effect on the combustion.—*London Engineer.*

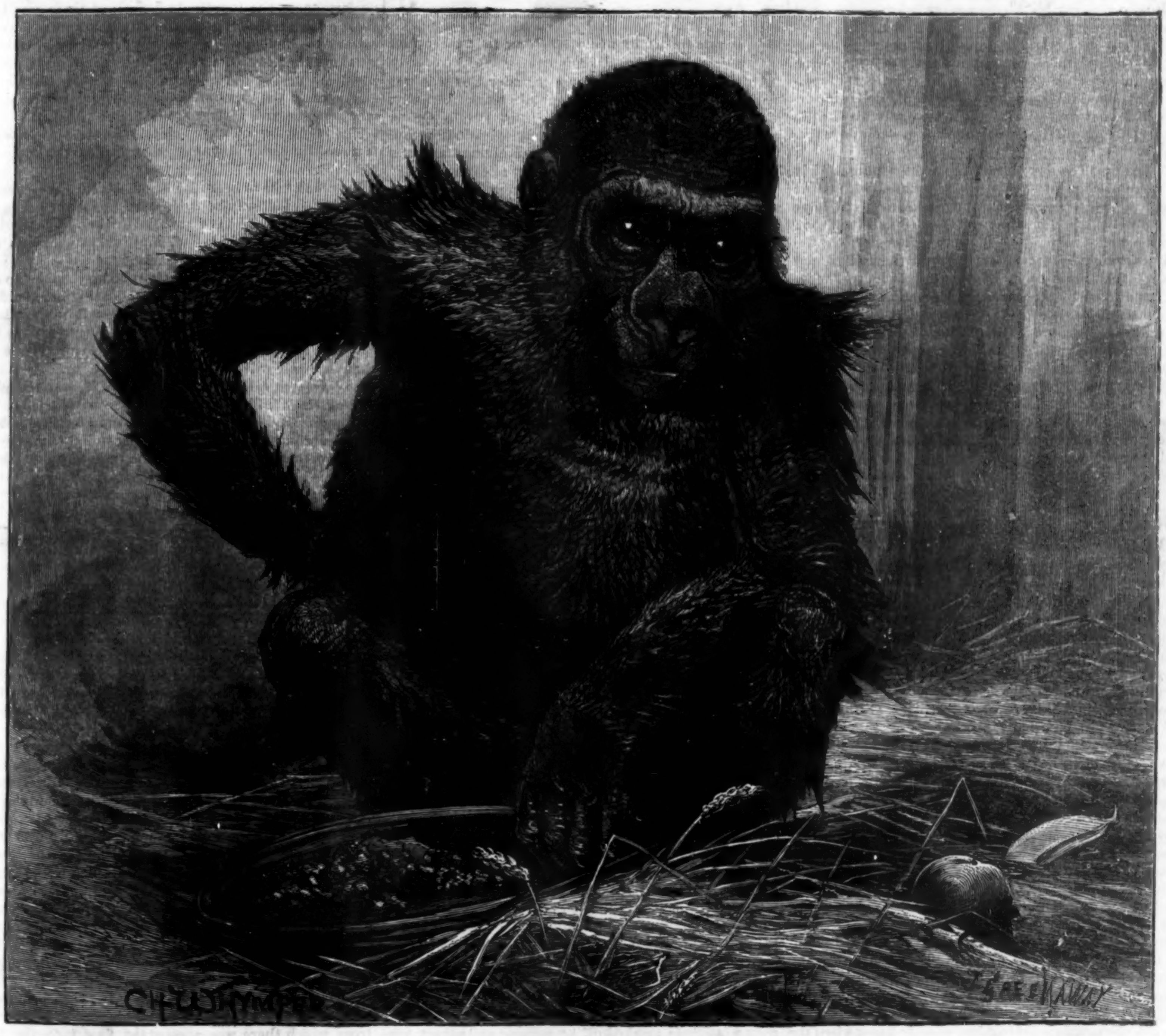




THE HARGREAVES THERMO-MOTOR.

A LIVE GORILLA IN LONDON.

For the first time since the establishment of the gardens of the Zoological Society, a living gorilla has been added to the collection. It is a young animal, but as little is known of the life history of these creatures, so rarely seen in captivity, and as it brought no certificate of birth with it from its native land, it is impossible to give more than a guess at its exact age. Although it has been scarcely a month in the gardens, it is rapidly recovering from the shyness before strangers which it exhibited at first, and it feeds freely on almost every kind of fruit offered to it, showing a marked preference, however, for pomegranates. It has unfortunately arrived at an unfavorable time of the year for an inhabitant of the forests of tropical Africa; but as it is placed in the same house and under the same care as the remarkably intelligent and well educated chimpanzee "Sally," which has now lived exactly four years in the gardens, it may be hoped that it has a chance of doing as well as she has, and of proving an even greater object of interest to visitors. The gorilla is a male, and has received the name of "Mumbo."—*Illustrated London News.*



THE GORILLA AT THE ZOOLOGICAL SOCIETY'S GARDENS, LONDON.

Candy-Making Hypocrites.

"Hypocrisy prevails in every trade but our own," is the sentiment too often expressed of late by the great confectioners of the United States. They are so elated by the growth and prosperity of their industry that they apparently overlook its many sins of omission and commission. Taken as a body, the American candy makers deserve much credit. The vile compounds which were so common twenty years ago are almost unknown to-day. Purer materials, better processes, new inventions, and higher skill and workmanship abound everywhere, and are seen in the plebeian lozenge as well as in the most costly bonbon.

For this change for the better, and, above all, this praiseworthy development, they merit high commendation. They get it also. Not only the general public praises them, but they themselves and their own journals indulge in a large amount of self-gratulation and wholesale flattery. In this respect they have unknowingly blown a very beautiful soap bubble, but still a soap bubble which is liable to be pricked by some one who knows. Their greatest danger lies in the hypocrisy of a number of their great dealers. Two in question are popular chocolate manufacturers. They can and do produce some of the finest and purest goods in the market. These are retailed in palatial shops at very high figures, and are naturally held up to popular admiration and esteem. The physician and chemist analyze them and pronounce them pure and superior in every regard, and the recommendation is published in every paper and read by every person in the land. Upon this popularity they do a wholesale business alongside of which their retail trade is the veriest bagatelle. But—and here lies the joke—the wholesale goods are not the same as those which are retailed, are not those which have been analyzed and commended, and are not what the public fancies it buys when it purchases. On the contrary, these wholesale goods are worthless and unwholesome stuff. Where they are supposed to be pure chocolate and white sugar they are mixtures of chocolate, starch, sugar, glucose, flavoring, and Venetian red. John Smith selling such vile composition would become a bankrupt in no time if he were not prosecuted for fraud and adulteration; but when made and sold by a concern famous for the purity and excellence of its output, no suspicion is excited, and the hypocritical manufacturer realizes a golden revenue.

To so large an extent is the evil practiced that it is an everyday matter to buy at retail in country stores goods made by distinguished houses for less than the wholesale price of the wares they sell to the great Broadway tradesmen. The fraud and imposition work wrong in more ways than one. They injure the health of the consumer; they also drive out of business small but honest concerns who put up pure goods. The tendency, therefore, is to lower the quality and finish of confectionery, to foster the use of imitants and adulterants, and to give the well known houses a monopoly of the business. It is high time that a stop was put to the nefarious traffic.

A second imposition and humbug is the vociferous shout by the confectioners that they use no adulterants, but, on the contrary, punish the adulterator, and then the confidential whisper that adulterants are only those substances which in normal quantity injure human health. Under this exquisitely ingenious arrangement they replace sugar and fine gum with glucose, vanilla with tonka and vanilline, almonds with myrbane oil, butter with oleomargarine, rose with geranium, and fruit flavors with compound ethers. They "dilute" cocoanut with starch, sugar, and terra alba, and use homeopathic and therefore harmless quantities of dyes and colors that in ordinary amounts are injurious, if not destructive, to the stomach. Of course they do but little harm by most of these practices. Glucose, tonka, oleomargarine, compound ethers, and saccharated cocoanut are, if in good condition, beneficent rather than otherwise. But it is none the less imposition, humbug, and fraud. Let the confectioners adopt the English statute, and stamp on every package all the ingredients their goods contain. If this were done to-day, there would be the greatest commotion and the wildest excitement their pleasant industry has ever known.—*American Analyst.*

Preservation of Flowers.

A method of preserving the natural colors of flowers, recommended by R. Hegler in the *Deutsche Botanische Monatshefte*, consists in dusting salicylic acid on the plants as they lie in the press, and removing it again with a brush when the flowers are dry. Red colors in particular are well preserved by this agent. Another method of applying the same preservative is to use a solution of 1 part of salicylic acid in 14 of alcohol by means of blotting paper or cotton wool soaked in it and placed above and below the flowers. Powdered boracic acid yields nearly as good results. Dr. Schonland, in a paragraph contributed to the *Gardeners' Chronicle*, recommends, as an improvement in the method of using sulphurous acid for preserving the color, that in the case of delicate flowers they might be placed loosely between sheets of vegetable parchment before immersion in the liquid, so as to preserve their natural form.

An Engineer's Life at Sea.

We will suppose a young engineer has applied for a berth, and that he has shown his certificate of indenture to prove that he has "served his time," the testimonials and letter of introduction, should he have one, have been found satisfactory, and that he is appointed third engineer say on a Mediterranean steamer. The young man goes aboard with some little anxiety and curiosity as to the other engineers, but these soon put him at his ease. For the first few days there is plenty of work to be done, assisting in the general overhaul of the machinery, during which time it is advisable to get acquainted with the engines, for one finds in the course of experience that every engine has physical, and I had almost said mental, peculiarities of its own; for the whole world of machinery has been built up from the thoughts of many minds, and each particular engine, being the idea of its constructor, embodied in iron and brass, has many of his mental peculiarities.

The first and second engineer will probably be found willing to give our young man every information; but they will be quick to discover if his tongue is more active than his brain. It is the best policy never to ask a question unless you cannot get the information in any other way. The firemen as well as the engineers, it should be said, are observant, and quickly note if the new recruit's intelligence equals his skill as a workman, and if he is an engineer as well as a mechanic.

By the time the day of sailing comes round a fairly good knowledge of the various pumps, with their levers and rods, their valves and cocks, etc., will have been obtained, and once at sea these details will soon become well known. On the day before starting, the engines are closed up, water run into the boilers, and the fires laid, ready to be lit about four hours before the time fixed by the captain for starting. About an hour before leaving dock, the second engineer takes our third below, and they proceed to open the discharge and feed valves, and to remove the turning gear. This is a most important matter, and if neglected will lead to burst pipes and a turning wheel stripped of teeth, or a broken worm on the turning screw. Then the oil boxes are filled, and the cotton siphons made ready to be put in. By this time steam is up, and the stop valve must be opened a little, and the engines "blown through" with drain pipes open. It may be noticed that the "second" does not blow more steam through the low pressure cylinder than he can help, so as not to overheat the condenser. If a circulating donkey pump is at work, this heating is not so likely to occur, but is always to be avoided.

Our "third" is now sent on deck to tell the officer in charge that everything is ready to take a turn out of the engines, and also to see if the propeller is clear of ropes, chains, or boats. After reporting all clear, a final look round the engines is taken, to see that no blocks of wood or hammers or chisels used in the overhauling are left to foul pumps or crossheads in their stroke, and the "third" takes his place at the starting wheel, which he has been shown how to work, the "second" meanwhile being at the steam handles. If the engines have not been properly warmed through, they will make most dismal and awful groans on starting, and will make the ship quiver, but with proper management this should not occur. "Put her ahead," and round spins the starting wheel, while the polished quadrants and eccentric rods come sliding over. A touch of the handles by the "second," and the engines stir, pull themselves together, and are off. "Stop and reverse her," and the ponderous cranks come to a stand for a moment, and then revolve in the opposite direction. Only two or three turns each way can be taken, as the vessel is fast to the dock wall, and strong ropes would break like thread if the engines were allowed to work much. Everything now being in readiness, the "third" returns to the deck and keeps a sharp lookout on the preparations for leaving, so as to know when the engines will really be wanted. When he sees that the pilot and captain mean business, he descends once more to his post at the starting wheel. The firemen are told to open their dampers and freshen up their fires, so that steam may not fail when the engines begin to draw on the supply, and he must also watch that the firemen do not allow their steam to rise so as to roar up the waste pipe. Now the "stand-by" rings, and the engineers are alert and the engines ready.

All this time the chief engineer keeps in the background; but he is not far off, and is ready to assist the "third" in a moment if required. Upon him rests the responsibility of all, but he leaves the new hand as much as possible to himself, that the latter may gain confidence.

At the last moment the "third" is warned to be quick with his starting gear, for the vessel is surrounded by shipping, and the least delay in obeying the telegraph may cause serious damage to his own ship or to others, or to the dock wall. A loud blow on the gong and the pointer is at "slow ahead," but scarcely have the engines moved than the order to stop and reverse and stop again are received, and for the next hour he has a busy time of it with his wheel. During this time the noisy clatter is heard of winches on deck, which, like more intelligent creatures, often make the most noise when doing the least work. When putting forth their strength one hardly hears them, but when pulling in loose ends of rope there is no silencing their rattle. The tramp of the sailors above and the words of command are also plainly heard; in the stoke hole is the ring of the firing tools; and in the engine room the muffled beat of the engines, with the occasional noisy rush of steam through the opened drain pipes of the cylinders. At last the word is passed down that the vessel is out of dock, and while the engines settle down steadily to their work, the "third" is allowed to go on deck to "have a blow." The steamer is now gliding down the river, which is alive with shipping, for it is full tide and crafts of all sizes are taking advantage of it. Presently the "third" is sent below again, for the pilot is leaving, and the engines must stop. When he has gone, the welcome order is given of "full speed ahead," and the vessel is fairly off on her voyage.—*Practical Engineer.*

The Development of Time Keeping in Greece and Rome.

An able and interesting paper under this title was read not long ago by Professor Franklin A. Seely, M.A., Examiner in the United States Patent Office, before the Anthropological Society of Washington. We regret our space prevents us from giving the paper in full. We cull a few sentences only:

In my room in the Patent Office there hangs a Connecticut clock of ordinary pattern and quite imperfectly regulated. Its variation of perhaps half a minute in a day, however, gives me no concern, since, being connected by wire with the transmitting clock at the naval observatory, it is, every day at noon, set to accurate time. At the moment of 12 o'clock there comes a stroke on a little bell and, simultaneously, the three hands—hour, minute, and second—whether they may have gained or lost during the preceding 24 hours, fly to their vertical position. Immediately after I hear a chorus of factory whistles, sounded in obedience to the same signal, dismissing the workmen to their midday meal. At the same moment, and controlled by the same impulse, the ball, visible on its lofty staff from all the ships in New York harbor, drops, and the seamen compare their chronometers for their coming voyage. The same signal is sent to railway offices and governs the clocks on thousands of miles of track and determines the starting and stopping and speed of their trains. It goes to the cities of the Gulf and of the Pacific as well as to those of the Atlantic coast—noted everywhere as an important element in the safe, speedy, and accurate conduct of commerce; and so the work of the regulating clock of the observatory, sent out by means which note the minutest fraction of a second of time, is playing its important part in the economy of our century. I cannot follow it out in detail; every one will do so to some extent in his own mind. But if we were to divide human history into eras according to the minuteness with which the passage of time is observed in the ordinary affairs of life, we should find ourselves to have arrived, and very lately, in what might be called the era of seconds.

At the opposite extreme is the period when the passage of day and night reveals itself to the dullest intellect. Perhaps no savage people have ever been so dull as not to have noted more than this. We can hardly conceive a state in which the brutal hunter did not take note of the declining sun and observe that the close of the day was approaching. The lengthening of his own shadow was an always present phenomenon, and men must have observed shadows almost as soon as they became capable of observing anything. But this kind of observation went on for ages without any attempt to subdivide the day, and none but the great natural periods marked off by sunrise and sunset were recognized.

There are three primitive forms of time-keeping instruments—the sun dial, the clepsydra or water clock, and the graduated candle. The sun dial was at the beginning the only time keeper, and man's ideas, developing into wants, led to its greater perfection, till these wants passed far beyond what, with its limitations, it could supply.

The rude utensil which the Greeks called a clepsydra had no resemblance to the perfected timepiece of this century, but nothing in history is surer than that out of it, by slow accretions, science and art, by turns mistress and handmaid, have produced the masterpiece of both.

Writers on the history of the clock (and they are not few) have generally begun by a reference to the sun dial as a Babylonian or Chaldean invention. We can trace it no further, and have no means of determining when the invention was made. We learn from the Old Testament Scriptures that it was known at Jerusalem as early as seven centuries before our era, and the manner of its mention indicates that in that city it was a novelty.

Historians have agreed in fixing the period of the introduction of the sun dial into Greece in the latter part of the sixth century B.C. Herodotus says it was derived from the Babylonians, from whom he also declares the Greeks to have derived the twelve parts of the day.

It does not appear that the sun dial was introduced to the Greeks in any perfected form. On the contrary, it was at first a mere staff or pillar, destitute of any graduated dial which could indicate the passage of an hour or any definite fraction of a day. The length of the shadow, measured in feet, determined the time for certain regular daily duties, as a shadow six feet long indicated the hour for bathing, and one twelve feet long that for supper.

The Greeks had written language and they had literature—Homer, Hesiod, Sappho. They had a system of weights and measures and a coinage. They were prolific in political ideas.

With her other arts, that of oratory had developed in Athens, but every orator was not a Pericles, and whatever may have been the merits or defects of their performances, the inordinate length of these was too great a tax on the tribunals. It therefore became necessary to limit and apportion the time of public speakers in the courts, and to do this equitably some practical means of indicating time was necessary. Hence arose the demand for another instrumentality whose origin and history are now to be traced.

The clepsydra or water clock, in its simplest form, is traced by historians no further than Greece, about 430 B.C.

I confess I have been far from satisfied with stopping at this half-way house in seeking for the origin of this instrument. I have sought further, and what I have found, if conclusive of nothing, is at least suggestive.

If, taking our lives in our hands, we could step on board a Malay proa, we should see floating in a bucket of water a cocoanut shell having a small perforation, through which the water by slow degrees finds its way into the interior. This orifice is so proportioned that the shell will fill and sink in an hour, when the man on watch calls the time and sets it afloat again. This device of a barbarous, unprogressive people, so thoroughly rude in itself, I conceive to be the rudest that search of any length can bring to light.

In Northern India, we find the rude cocoanut shell developed into a copper bowl. Its operation is the same, but the attendant, who stands by and watches the moment of its sinking, now strikes the hour on the resonant metal.

I next observe the water clock in use up to this day in China. We find the metal vessel with its minute perforation as before, but it has undergone a radical change in respect to its manner of use. It is now filled and the water flows from it in drops. Obviously enough, the flight of time might be indicated by merely observing when the vessel has emptied itself and then refilling it, which, as will presently appear, was exactly the simplest Greek and Roman clepsydra, and differs in no mechanical respect from the ordinary sand glass.

But in the days when the Chinese were a progressive people and developed inventions for which Europe had many centuries to wait, this water clock advanced far beyond the crude thing we have been considering. It would seem that the problem was to increase its usefulness by subdividing the unreasonably long intervals required for the complete emptying of the vessel. If this was done by marking graduations on the inside of the vessel, and so noting the decline of the level, the difference in its rate could not fail quickly to make itself manifest. The solution of this problem, not obvious at first, was found in so arranging the vessel that it should discharge into another, where the indication would be read in the rise of the surface, and contriving to hold the water in the upper vessel at a constant level. This was done by employing a third source, from which there was a constant flow into the first equal to its discharge. As the head in the middle vessel is thus maintained constant, the rise in the lowest is made uniform. Another radical improvement enhancing the practical utility of the device was the arrangement of a float on the surface of the water in the lowest vessel. Upon this was an indicator or hand which, in its rise, traveled over an adjacent scale, and so gave a time indication visible at a distance.

To show what progress this structure implies in the development of the mechanical clock, it is worth while to glance a moment at the essential elements of such an instrument. Reduced to its lowest terms, a clock consists of three elements only. These are a motor, or source of power, represented in our clocks by a spring or weight; an escapement, or a means by which the stored power in the motor is let off at a measured rate; and a dial, which is but the means by which the rate at which the power is let off is made visible to the eye. In this Chinese water clock we discover all these elements.

Lemmings are very numerous in several valleys in Southern Norway this winter. In many places the snow is furrowed for miles by the march of these little animals on their migration southward.

APPARATUS FOR ILLUSTRATING NEWTON'S LAWS.

T. O'CONOR SLOANE, PH.D.

The elementary or fundamental laws of force, known generally as Newton's laws, and variously formulated in the different text books, may be illustrated by the use of the apparatus shown in the cut accompanying this article. In general terms, it consists of an arrangement for projecting or throwing a marble in a horizontal direction. A piece of board, about 2½ inches wide and 8 or 10 inches long, forms the base of the apparatus. On each side are fastened two thin strips, that rise half an inch from its surface, so that a wide, shallow groove is formed. A block of wood, about 4 inches long, is made of exactly the width of the groove, so as to slide freely in it with no lateral shake or "lost motion." Pins are driven into its rearward end, or a little bar is nailed across its upper surface, near the end, and projecting on each side. Corresponding pins are driven into the base of the apparatus, near its front. These are for the reception of springs.

For the latter, India rubber bands, or, what is far better, spiral wire springs, may be employed. These are attached to the two sets of pins, as shown in the engraving, so that the sliding block is drawn forward and downward by them. The springs, in drawing the end of the block downward, carry out an arrangement adopted to keep the block in position. Were the pull of the springs horizontal, there would be a constant liability on the part of the springs to throw the block up and out of its seat.

To prevent the block from being drawn too far forward, strings limiting its motion in that direction are attached to the same pins that hold the springs, and thence are carried to the rear end of the base. When the springs are at the end of their strain and just ceasing to pull the block forward, the strings come into play and prevent the block from going any further forward. This leaves a space of three or four inches free in front of the sliding block.

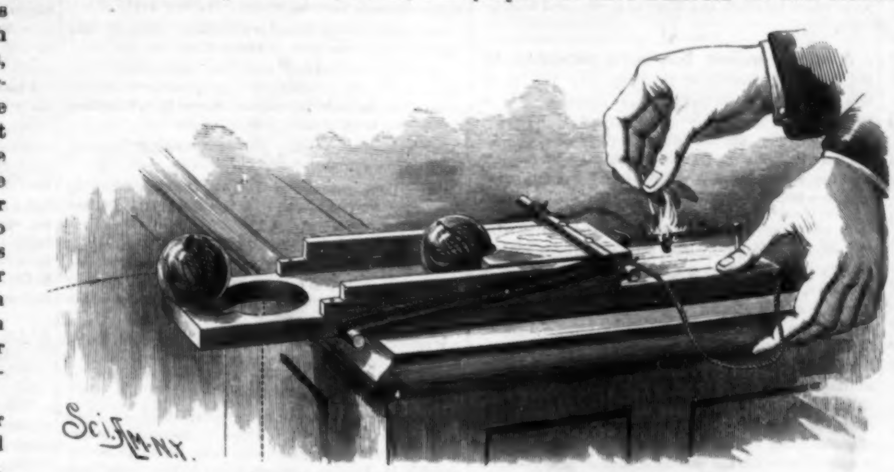
As near the front of the baseboard as possible a large hole is made. This should be considerably larger than the marble it is proposed to employ. The dimensions followed in this description apply to an apparatus constructed for marbles of 1½ inches diameter. The hole where these are used may be made about 2 inches in diameter. It is well to have the front end squared out. Across the front a strip of wood is left about one-half inch wide. Exactly in the center of this strip a slight depression, which need not exceed one-sixteenth of an inch in depth, is made. With equal exactness a notch—a triangular one is best—is made in the center of the front end of the sliding block. This notch should be about three-quarters of an inch across. If the block is drawn back, a marble placed on the base against the sliding block, and lying in the notch, when the block is released the marble will be projected across the depression in the front of the apparatus.

To illustrate the law that forces act upon a body independently of each other, and also to present an incidental illustration of the law of impact of elastic bodies, the block is drawn back and tied back, as shown. Hooks or nails are provided for this purpose, one on the block and one on the base. The apparatus is placed on the edge of a horizontal table and held firmly there. One marble is placed resting in the depression in front; the other is placed against the sliding block. The string is now burned through with a match.

As the string parts, the block is drawn forward, driving the marble also before it. As it goes forward it strikes the other one in front. The impact, in virtue of the law as affecting elastic bodies, stops its course. Nearly all its mechanical energy is imparted to the other ball, which at once flies forward six or eight feet before it touches the floor. The first marble thus checked falls vertically through the large hole. Both marbles strike the floor with one report. The vertically falling and horizontally projected ball reach the ground simultaneously.

By using a single marble and placing the apparatus on rollers, on projecting the marble, the distance to which it will go will be much abridged, while the apparatus will fly back. This illustrates action and reaction. By endeavoring to repeat the first experiment with the apparatus on rollers, the front ball will tend to fall vertically, and the other ball will go over it and fall in advance, and probably will collide with it in passing over it.

The mode of release by burning a string is far the best, as it avoids all disturbance. Accuracy of construction is essential. Glass or stoneware marbles answer admirably. As fast as they break, new ones can be substituted. Wooden or ivory balls are not sufficiently elastic, although far more durable.



APPARATUS FOR ILLUSTRATING NEWTON'S LAWS.

Conserve Your Force.

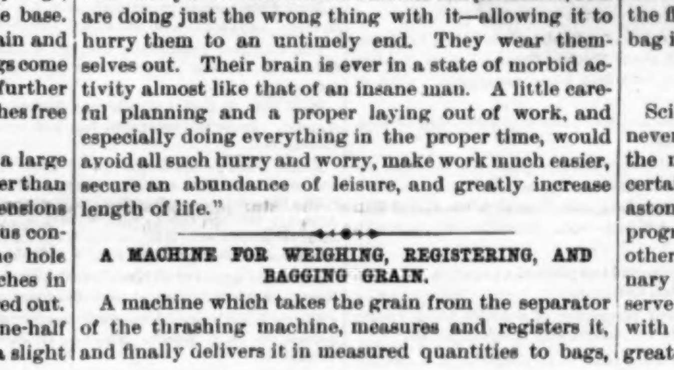
Hamerton says: "It often happens that mere activity is a waste of time, that people who have a morbid habit of being busy are often terrible time-wasters, while, on the contrary, those who are judiciously deliberate, and allow themselves intervals of leisure, see the way before them in those intervals, and save time by the accuracy of their calculations."

Another writer, unknown, says:

"Some men are in incessant action, early and late and all through the day. They have no time for family or friends. As for holidays, the less for them the better. They have inherited a nervous temperament, and are doing just the wrong thing with it—allowing it to hurry them to an untimely end. They wear themselves out. Their brain is ever in a state of morbid activity almost like that of an insane man. A little careful planning and a proper laying out of work, and especially doing everything in the proper time, would avoid all such hurry and worry, make work much easier, secure an abundance of leisure, and greatly increase length of life."

A MACHINE FOR WEIGHING, REGISTERING, AND BAGGING GRAIN.

A machine which takes the grain from the separator of the thrashing machine, measures and registers it, and finally delivers it in measured quantities to bags, has been patented by Mr. George R. Kendrick, of Bucyrus, Ohio, and is shown in the accompanying illustration, Fig. 2 representing the grain-measuring receptacle, with its hinged bottom open, and Figs. 3 and 4 the cam of the shifting mechanism, with the levers in different positions. The upper shaft of the elevator, which is connected at its lower end with the separator of a thrashing machine, is connected by a sprocket wheel and chain with a lower shaft in a swinging frame, the latter shaft carrying a pinion adapted to mesh into a gear wheel, which has its teeth depressed in one part of its rim, this gear wheel being secured on a shaft mounted to rotate in suitable bearings on the main frame. From the face of this gear wheel also projects a lug adapted to engage, at each revolution of the wheel, an arm having an offset, on which rests the lower end of an arm secured to the swinging frame, whereby the doors forming the bottom of the receiving spout are automatically opened and closed, as the grain-measuring receptacle is being filled or discharged. The weighing beam is hung in suitable bearings on an arm fastened on a shaft mounted vertically on the main frame, the outer end of the beam being connected with a spring scale, and its inner ends supporting the grain-measuring receptacle, the bottom of which consists of two hinged doors pivotally connected with each other, so that the doors open and close simultaneously, the receptacle swinging with the vertical shaft, so as to discharge alternately into hoppers placed alongside of each other, each having hooks at its lower end on which the bags to be filled are hung. The amount of grain passed into the bag is shown by the scale, a registering device registering the amount. The swinging motion of the vertical shaft, enabling the operator to discharge the grain alternately into the hoppers, or two or three times successively into one hopper before changing to the other, is readily regulated by a simple adjustment of the lever with segmental arm in connection with the cam and pawl shown at the front of the machine, the two hoppers permitting the operation to be continuous, as, while one bag is being filled, the operator can remove the filled bag from the other hopper and put an empty bag in its place.



KENDRICK'S GRAIN WEIGHING, REGISTERING, AND BAGGING MACHINE.

Atmospheric Influence on Combustion.

Scientific minds, says the *American Artisan*, have never been able to give a satisfactory explanation of the mysterious atmospherical influence which aids, at certain times, in causing conflagrations to spread with astonishing rapidity, and makes the checking of the progress of the flames so much more difficult than at other times. Every one who has attended to an ordinary grate or stove has had frequent occasion to observe that a fire which burns brightly at certain times with a certain draught, requires at other times a much greater draught to keep it from going out. This result, in the great majority of instances, is attributable to occult causes, which neither science nor practical observation has ever yet been able to cope with or satisfactorily explain. The simple fact remains that the earth's atmosphere in its different conditions is a subject concerning which, like a great many other things, science is able to explain infinitely less than professed scientists are willing to admit.

There are certain philosophical truths in regard to the atmosphere which surrounds us which are generally understood, but there are still others, in reference to which the *savants* of the nineteenth century remain as profoundly ignorant as were the early Romans; and among the very many unexplained and mysterious phenomena connected with the subject of the air we breathe, science is wholly at sea with reference to the numerous phenomena produced by the action of the elements on fire at different times, whether the same be confined in stoves and grates or whether it takes on the nature and conditions of an open and disastrous conflagration.

Fire Engines Operated by Electricity.

A great improvement in the handling and working of fire engines might be brought about by the application of electricity, says the *Jewelry News*. In fact, an engine can by such means be operated from a central station in the same manner as electric light is distributed over a large space or a city. While the pumps are being attached to the hydrants, the engineer may be attaching the connections of his motor to the proper wires, and the alarm having notified the central station, the electric current therefrom would operate the fire engines, entirely avoiding the transport of heavy accumulators, either on the engine or the hose carriage. Other great advantages would be in the lighter weight of the engine, and hence the greater speed and ease with which it could be taken to a fire; and also the celerity with which it could be brought into action, and its reduced cost.

ENGINEERING INVENTIONS.

A cable grip has been patented by Mr. John F. West, of Staunton, Va. The invention covers a simple device for operating movable jaws to grip the cable, and to lift the jaws, together with the grip head, above the line of the operating cable, to pass cross cables or sheave rollers of other lines.

A petroleum engine has been patented by Mr. Adolf Spiel, of Berlin, Germany. This invention covers a construction whereby the oil is drawn in with and mixed with air and then compressed before ignition, the quantities mixed and the compression being automatically regulated, and the construction being an improvement on a former invention of the same inventor.

A railroad signal has been patented by Mr. Randolph F. Hageman, of New Madison, Ohio. Combined with levers located at opposite sides of a crossing and pivoted to the rail, is a weighted lever operated by the pivoted levers when a train passes over, a signal arm and signal being operated by the weighted levers, making a signal which is automatic in operation.

A fish plate has been patented by Mr. Thomas A. Davies, of New York City. It has a head with substantially cylindrical surface to extend to the head of the rail, and an outwardly projecting longitudinal lip at the base, making a strap plate giving an equal amount of bearing surface upon the base and head of the rails.

An apparatus for filling blast furnaces has been patented by Mr. Samuel Thomas, of Catasauqua, Pa. It consists of a track leading to the top of a furnace and provided with an inclined frame, a car having a dumping mechanism operated by the frame, with means for returning the car after dumping its contents, and for pushing the loaded car to the top of the furnace.

A car coupling has been patented by Mr. Charles S. Edwards, of Forkland, Ala. The drawhead has a mortise for the coupling bar and a transverse bearing for engagement by the hook of the drawbar, an uncoupling lever being pivoted in rear of this bearing, the invention covering various novel features of construction and combination of parts, making a simple and ready working device.

MISCELLANEOUS INVENTIONS.

A wire fence has been patented by Mr. James King, of Sandusky, Ind. The invention covers a novel construction and combination of parts whereby a strong fence may be made with few parts, neat and tasty in appearance, and easily built on undulating as well as level ground.

A support for electric conductors has been patented by Mr. Maurice J. Hart, of New Orleans, La. It consists of a series of towers erected at the intersection of streets, with cross bars for supporting conductors, and combining therewith a footbridge supported from the cables, all above the general level of the housetops.

A holder for yard sticks has been patented by Mr. Max Levy, of Newport, R. I. It is for supporting the yard stick near the edge of the sales counter in position for measuring off goods, whereby the work is facilitated, while when not in use it can be readily removed out of the way.

A plumb level has been patented by Messrs. Edwin A. Wentworth and Adelbert J. Traver, of Atchison, Kansas. It is so made that it can be used with equal facility in a common stock or on a straight edge of any desired length to indicate the rise or fall of an unlevel surface from a fourth of an inch or less to twelve inches to the foot, or so many feet to the rod.

A stove has been patented by Mr. Henry Waterman, of Brooklyn, N. Y. The fire chamber has on one side a horizontal hollow inwardly projecting upper breast, with aperture leading through the sides of the stove, and transverse air outlets, there being an externally projecting feeding chamber, and other novel features, making a stove especially designed for burning bituminous coal.

A wire drawing machine has been patented by Mr. Martin F. Roberts, of Kilborn, Middlesex County, England. Combined with the driving shaft and a counter shaft is a friction disk mounted on a feather key, and a second friction disk driven at varying speeds, and secured on a shaft on which a drawing-through pulley is also secured, whereby any required number of dies and die holders, with drawing-through pulleys, may be used.

A road cart has been patented by Mr. Philip Fiege, of Lanesville, Va. A rectangular frame is secured at or near its rear corners to the upper members of the springs, the thills extending under the frame and being hinged to the side bars, the cross bar connecting the thills directly below the cross bar of the frame, while a curved spring is secured to the under side of the front bar, and bearing at its ends on the upper surface of the cross bar.

A fence has been patented by Mr. Reuben B. Eubank, Jr., of Maryville, Mo. It has panels, cross bars or sills, binding wires, with bearings for securing the arms of the binder when tightened, and other novel features, making a simple portable fence, which will be firm and steady, and can be readily erected on ground having an irregular surface.

The binding of blank books forms the subject of a patent issued to Mr. Thomas Beckett, of Jersey City, N. J. The invention consists of leaf sections having their leaves connected by stitches before the sections are connected with each other by parchment bands and the ordinary stitching, giving more strength and stability than blank books bound in the ordinary manner.

A secondary electric clock has been patented by Mr. Wirt B. Harvey, of Memphis, Tenn. It is designed to operate in a circuit where a regulator or master clock causes the circuit to be closed for a short time during each minute, the invention being designed to simplify the action and increase the efficiency and certainty of operating, connecting and synchronizing the hands of the secondary clock.

A buckle has been patented by Mr. Alexander P. Waddell, of Union City, Tenn. It is designed especially as a trace carrier, and has a sliding plate, with means for attachment to the strap, in combination with a hinged plate permanently secured to and adapted to fold thereon, the plates each having parts which interlock and serve to receive and hold the trace.

A spoke socket has been patented by Mr. William E. Hardin, of Monterey, Ky. The invention consists in the formation of the clip adapted to be applied to the felly and for the reception of the end of the spoke, being especially applicable where a spoke has been broken at its tenon or a felly so split as not to hold the spoke and it is desired to continue its use or replace a broken spoke without taking the wheel apart.

A sewing machine, and a take up and tension for sewing machines, form the subject of three patents issued to Mr. Emilio Querol y Delgado, of Brooklyn, N. Y. The sewing machine is adapted to form one or two parallel rows of stitching, the distance between the needles and the shuttles being adjustable to suit the width of the parallel rows of stitches to be made, while one of the needles and its corresponding shuttle and thread may be dispensed with and the machine operated as a single stitch machine. The take-up device consists of a novel construction and arrangement of parts, being simple and durable, and very effective in operation, while the improved tension mechanism is adapted to prevent a too rapid unwinding of the thread, and also to prevent breakage thereof.

SCIENTIFIC AMERICAN

BUILDING EDITION.

MARCH NUMBER.—(No. 29.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing perspective elevations and floor plans of a cottage of moderate cost, together with full specifications, sheet of details, etc., etc.
2. Plate in colors of a handsome suburban residence, costing about Twelve Thousand Five Hundred Dollars, with floor plans, specifications, sheet of details, etc.
3. Elevations and floor plans of two dwellings of moderate cost.
4. Perspective view and floor plans of a house for Six Thousand Dollars.
5. Floor plans and elevations of a substantial residence at Tuxedo Park.—James Brown Lord, architect.
6. Perspective and two plans of a Cape Cod cottage of moderate cost.
7. Plans and perspective of a double house, costing about Six Thousand Five Hundred Dollars.
8. Elevation and plans of an alteration of a dwelling on Long Island.
9. Sketch of a one story residence erected at Birmingham, Ala., at a cost of Four Thousand Five Hundred Dollars.
10. Floor plans and perspective view of a neat cottage for Seventeen Hundred and Fifty Dollars.
11. Plans of an English country house.
12. Sketch of a handsome double house at Cleveland, Ohio. Cost, complete, Six Thousand Dollars.
13. Illustration of a house costing Three Thousand Dollars.
14. Designs of two substantial churches, costing about Four Thousand Dollars each.
15. Elevation and floor plans of a brick residence at Newark, N. J. Cost, complete, Seven Thousand Six Hundred and Seventy-five Dollars.
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17. Design for a carriage house and stable. Cost, Fifteen Hundred Dollars.
18. Plan of an old plaster ceiling, South Quay, Yarmouth.
19. Architectural Suggestions.—A Stairway in the Hotel Cluny.—A Stairway in Rouen.
20. Miscellaneous Contents: Ancient Water Works.—Making the House Water-Tight.—Mahogany.—Vibration of Buildings.—Building Accidents.—The Column Vendome, Paris.—Learning to Design Buildings.—Non-Inflammable Wood.—Large Redwood Boards.—An Experiment on the Expansion of Iron in Buildings.—Ornamental Hedges.—The Acoustics of Buildings.—Suggestions on House Painting.—Right and Left in Landscape Painting. Furniture Woods.—Range Boiler Explosion, with illustrations.—Plastering of Walls, Westminster Hall.—Notes on Bricks.—Mineral Wool.—The Jackson Ventilating Grate, illustrated.—The Spencer Hot Water Heater, illustrated.—The Alsop Furnace, illustrated.

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THE METALLURGY OF SILVER, GOLD, AND MERCURY IN THE UNITED STATES. By Thomas Egleston. Two vols. Vol. I. Pp. 558. $7.50. New York: John Wiley & Sons.

Professor Egleston has been for many years a professor of mineralogy and metallurgy at the School of Mines, Columbia College, and, in addition to the advantages afforded by his professional training, has had superior opportunities to become acquainted with most that has been done in the mining and metallurgy of the metals treated of in the United States for many years. This volume treats mainly of the mining of silver and the working of its ores, concerning which most elaborate details are given of the machinery and processes that have been and are at present employed, including specific descriptions of the plant and mode of working at the present day in many of the most prominent mines. Stamp mills and crushing machinery, furnaces for roasting ores, and apparatus for amalgamating, are described with such detail, in connection with many valuable scale drawings, that the work cannot fail to be of great assistance to the mining engineer, and invaluable to the seeker for comprehensive information on the general subject.

L'ANNEE ELECTRIQUE. By Ph. Delahaye. 4me Annee. Paris: Baudry & Co. 1888. Pp. xv, 359.

This useful annual again has reached us, marking the progress of another twelve months. In its pages we find treated electric lighting, primary and secondary batteries, telegraphy, telephony, distribution of force, and all the other phases of electrical work and progress. To those conversant with the French language, no more useful and concise compendium could be recommended. Its obituary notes, giving the necrology of the year, are of value as a brief record of the departed ones.

INDUSTRIAL INSTRUCTION. By Robert Seidel, Mollis, Switzerland. Translated by Margaret K. Smith, Oswego, N. Y. Cloth. Pp. 170. Price $1.00.

Besides a skillful refutation of the objections that have from time to time been raised against industrial instruction in the schools, the author has presented in this book a philosophical exposition of the principles underlying the claims of hand labor to a place on the school programme. It gives in vivid, because homely, phrases the present aspect and prospects of industrial training. No branch of education excites the same interest at the present day as this one, because all seems pointing to the extensive introduction of manual training in the schools of America. It has to be tried and developed on a grand scale here. Hence this work is a timely publication, and should meet with much encouragement from those interested in the culture of the race.

THE MANUAL TRAINING SCHOOL. Its Aims, Methods, and Results, with Detailed Courses of Instruction in Shopwork and Drawing. By Professor C. M. Woodward, of the Manual Training School, Washington University, St. Louis. Cloth. Pp. 374. Price $2.25.

This book, as the publisher states, is exceedingly practical, its main object being to show just how a manual training school should be organized and conducted. It contains courses of study, programmes of daily exercises, and working drawings and descriptions of class exercises in wood and metal. The course of drawing, which has proved eminently successful in the St. Louis school, is quite fully given. The book includes a full description, with illustrations, of the work done in this somewhat famous institution. The different samples of woodworking, blacksmithing, turning and founding, are of interest and add largely to the practical value of the book. It is a work which would serve as a teacher's guide, for founding a school to tread in the path so well marked out by Professor Woodward's professional labors.

MANUAL OF ENGINEER'S CALCULATIONS. By D. McLaughlan Smith. St. John, N. B., Barnes & Co. 1886. Pp. 346. $3.00.

This work bears the marks of the working engineer throughout. It is written with special reference to the Canadian examinations. It gives many popular expositions of natural laws. The practical steam worker will doubtless find much that is useful in its pages. It has as frontispiece a heliotype portrait of Mr. William N. Smith, the author's father, said to be the oldest steam boiler inspector in America, and his biography is included in the work.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC AND PHOTOGRAPHER'S DAILY COMPANION. 1888. $1.00. Henry Greenwood & Co., London, England. Pp. 710.

This is an excellent compendium of the principal items of photographic interest for the past year, containing suggestions and formulas of especial value to the photographer and amateur. Twenty pages devoted to "Technical Essays for Young Photographers" will be found very useful for beginners. The book has for a frontispiece an illustration of the Thistle, made on bromide paper, by Morgan and Kidd, from a negative by Arthur H. Clark, Esq.

PHOTOGRAPHER'S DIRECTORY. A directory for photographers, lithographers, and for all allied trades in the United States and Canada. The Lithographic Publishing Company, New York. 1887-88. Pp. 202.

This is one of the class of trade directories that within the last few years have grown of such importance in trade circles. The work is well and clearly printed, and is a valuable addition to its class of literature.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) **F. M. asks why a large quantity of** leaf tobacco wet with fresh water gets hotter than the same quantity will, wet with strong solution of salt water. A. Salt is an antiseptic, and retards fermentation. Fermentation is the cause of the heating.

(2) **H. V. J. asks: What is the ratio of** the length of a vibrating reed, rigidly fixed at one end, to its rate of vibration? For instance, a strip of elastic metal, the length of which is n, vibrates 50 times per second. What will be the length of a strip of the same material, and cross section, to vibrate 200 times per second? A. The rate of vibration varies inversely as the length. In the instance given, the length for 200 vibrations should be $\frac{n}{4}$.

(3) **J. K. asks if there is any way to** take pieces of plank apart, after they are glued together. A. Immerse in boiling water or expose to steaming.

(4) **W. F. N. asks: 1. What is the temperature** of water at its greatest density? A. 4° C. or 39.1° Fah. 2. What is the weight of a cubic foot of water at its greatest density? A. 62·425 pounds avoirdupois. 3. How much is it expanded in heating it to 62° Fah.? A. 100,000 volumes at 32° Fah. become 100,095 volumes at 62° Fah. 4. The current of a battery having an E.M.F. of 1 volt working through a resistance of 1 ohm gives 1 ampere. Now, if the resistance be doubled, what effect will it have on the current? A. Calling the external resistance R. and the resistance of the battery R, and the E.M.F. E (in your case equal to 1 volt), the current is equal to $\frac{E}{R+R}$ If R+R=1, then the current is equal to 1 ampere. If R+R=2, the current is equal to ½ ampere. Your question is not clearly stated, as you do not say whether the 1 ohm resistance includes the battery or not. The resistance of the battery cannot be left out of account.

(5) **G. W. asks how liquid cherry stain is** made, such as furniture manufacturers use. A. Take 3 quarts water, annatto 4 ounces; boil in a copper kettle till the annatto is dissolved, then put in a piece of potash the size of a walnut. Keep it on the fire about half an hour longer, and it is ready to bottle for use.

(6) **J. H. T. wants a receipt for making** a liquid blacking, that will make a good shine and a quick one. A. Take of gum shellac 2 ounces, and dissolve in 3 quarts alcohol, then add 1½ ounces camphor, and 2 ounces lamp black.

(7) **W. C. asks (1) what to use for removing** kerosene from an ingrain carpet. The oil is about 115° test. A. Use ether, chloroform, turpentine, or carbon disulphide as a solvent. 2. What is the steam pressure usually used on high and low pressure engines? A. Engines are now built in such variety that it is not possible to give a definite answer. From 30 to 50 pounds would generally be considered a low pressure, and above 70 pounds might be considered high pressure, although many compound engines use steam at a pressure of 150 pounds and over. 3. Can you tell me where I can get a good chemistry? A. Fownes' Chemistry, revised by Watts, which we mail for $3.75, or Bloxam's sixth edition (just out), which we mail for $4.50, are probably as good chemistries as can be obtained for the money. They each treat of both inorganic and organic chemistry in a way to be comprehended by any intelligent person, while being very comprehensive in their scope.

(8) **B. A. asks how oil-cloth cloths, commonly** called oil skins, are made. A. Dissolve together white resin, pulverized, 8 ounces, bleached linseed oil 6 ounces, white beeswax 1½ ounces, then add sufficient turpentine. Apply to both sides of the cloth while it is stretched tight.

(9) **A. S. P. asks: Which would be the** easiest on a steam pump filling a tank—to discharge the water into the bottom or top of the tank? A. There is less pressure in the flow pipe when feeding into the bottom of a tank. The difference is too small to be perceptible in ordinary pumping, it being only 0·43 of a pound for each foot that the top flow pipe is above the water in the tank.

(10) **W. D. W. asks a receipt for the** prepartion used for blacking brass work, such as the finger buttons of a writting machine. A. Dip the buttons in a solution of chloride of platinum, and heat gently to dry. Two or three dips will give them a black surface.

(11) **D. F. F. asks the best method of** engraving on brass, by a solution that will not, as nitric acid does, make the letters or design run. A. Probably you make the acid too strong. Try it weaker, and mix ¼ acetic acid with it for your biting liquid. Also see that you have good wax for ground. Pure asphalt melted with beeswax, equal parts, and put on the warm plate with a pad, makes the best ground.

(12) **M. G. W. writes: I notice in a steel** rolling mill, salt is thrown on the plates while being rolled, for the purpose of removing scale, etc. What chemical action takes place, and does it not have a deleterious effect on the rolls? A. The action is chemical and mechanical. The salt melts and becomes a flux on the surface of the metal, and in that way assists in making the plate smooth by preventing oxidation. It also used mixed with sand for flux in weld furnaces.

(13) **H. W. F.—Images of any material,** such as clay, plaster of Paris, or wax, may be coated with copper, and the copper bronzed. The coating will necessarily be very thin, to prevent roughness. Clay and plaster images should be thoroughly waxed on the surface, to give adhesion to the plumbago surface which is necessary for the electro deposit. By care and a slow action of the battery, and proper management of the solution, a sufficient thickness of copper may be obtained to allow of the wax being melted out and the cavity filled with solder, which melts at a much lower temperature than lead, or fusible alloy, or type metal. This has been used experimentally, but we do not know that it is practiced to any extent in the arts. Images and ornaments cast in zinc and electrotyped with copper, and then bronzed, are largely a trade in Europe and the United States.

(14) **J. H. G. writes: I see street dealers** using a soldering substance in their work which is melted by an ordinary candle and is used without the aid of resin, acid, or ammoniac, and appears to do good work. Can you tell me anything as to its composition? A. It is bismuth solder. Composition 50 parts tin, 25 parts lead, 25 parts bismuth by weight.

(15) **T. P. H. asks: Is there any chemical** mixture that will sharpen old files? A. Boil the files in strong soda and water to clean off all grease, oil, or gum. Then dip for a few minutes in a bath of nitric acid 1 part, water 4 parts; the length of time being less on fine files, as your experience may suggest.

(16) **G. E. M.—The tides in all parts of** the world vary according to the contour of the coasts. The Bay of Fundy is a striking example of an ordinary tide sweeping into a funnel-shaped bay, at the head of which the tide is 70 feet. On the north coast of South America is a fair example of the retarding effect of islands and reefs; the Windward Islands so obstructing the Atlantic tidal wave as to reduce it to from 1 to 1½ feet, while the broad Pacific Ocean sweeps into the recessed bay of Panama a tidal wave of 24 feet. The same effect takes place in Long Island Sound, the tides being less at Martha's Vineyard than at Bridgeport, the narrowing of the sound causing the tide to accumulate at its western end.

(17) **J. M. B. asks why it is that it** takes so much longer for water to boil or food to cook in a new tin vessel than in an old one. A. Because the new tin is bright and smooth, and thereby reflects the heat instead of transmitting it. Old tin is dark and rough, absorbing heat quickly.

(18) **A. H. W. asks if it will require more** or less fuel (coal) at a high altitude than at a low one to furnish the same pressure of steam in a boiler, and if there is a difference, what is the ratio. A. The same amount of fuel will be required in either case stated.

(19) **L. O. S.—To make a camera obscura** see SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, containing illustrations.

(20) **J. W. L. writes: I have a horse** shoe magnet made of ⅜ by ⅜ inch steel, and 2½ by 4½ inches, the poles of which do not fit the connecting bar. Will it injure the magnetic properties to file or grind it to fit? If so, how shall I renew it? I have for several years been sending yearly packages of my SCIENTIFIC AMERICAN to the Light House Board, to distribute to the light keepers. Is that the best disposition to make of it? A. Your magnet will undoubtedly suffer in grinding the ends. Your disposition of the SCIENTIFIC AMERICAN is commendable.

(21) **W. J. H. writes: 1. I have about** 700 lb. of fine brass filings and brass dust. What is the best way to melt the dust without burning, etc.? A. Pack the filings and brass dust in a crucible as tightly as possible, and place a little charcoal dust on top. Melt in a brass furnace and pour into an ingot. Better sell it to a brass founder.—It would be a tedious and uncertain computation to obtain the amount of force with which a 2 in. gas pipe will strike the bottom of a bored well containing 1,600 feet in depth of water, and 2,100 feet deep.

(22) **A. W. M.—The speed and pitch of** propellers for best effect depend largely upon the relative areas of midship section, its form, and the lines of immersion; the whole displacement and area of circumference of propeller being also factors in the computation. Ordinary propeller wheels are made for a speed of from 150 to 300 turns per minute. A speed of 95 feet per second on the periphery of a propeller wheel will cause a partial vacuum, depending upon the speed of the wheel and vessel ahead. Thus a wheel turned with great speed when the boat is fast at a dock loses much of its power by the vacuum sucking the air under the wheel. Wheels are usually of 2 or 3 blades, and for bulky boats have a pitch about equal to their diameter. With boats having fine lines, the pitch may be extended to twice the diameter of the wheel. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 101, 278, 15, 208, for interesting illustrated articles on screw propellers.

(23) **T. P.—The pressure per square** inch of surface for all boilers is alike for similar pressures by the gauge, but the strain on the cylindrical shells of boilers is in proportion to their diameters. Thus the absolute strain tending to split the shell of a boiler 4 feet in diameter is twice as much as in a boiler of 2 feet in diameter and may be illustrated by laying a stick 24 in. long on two bearings at the end, and one also 48 in. long in a like position. If you place a pound weight on each inch of each stick, you will find that one is carrying twice the strain on its bearings that the other does. Its bearings represent the shells of the boilers. This agrees with actual experiments on boilers.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

February 14, 1888,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising device, F. C. Briggs ... 377,925
Air, carbureting, R. M. Bidelman ... 377,735
Alloy, metallic, J. Webster ... 377,918
Amalgamator, W. & G. W. Johnson ... 377,760
Amalgamator, carbon, W. H. Lawrence ... 377,901
Armature coils, frame for winding, R. Eickemeyer ... 377,907
Ash conductor, J. H. Whittle ... 377,921
Axle lubricator, car, S. Hatt ... 377,754
Axle, vehicle, Peckham & Laass ... 378,058
Axles, roller journal for car, Moyer & Youlls ... 377,896
Bag turning, folding, and printing machine, J. W. Wells ... 377,972
Bags or valises, fastening for traveling, H. W. Morrow ... 378,016
Balance spring for window or other slides, G. W. Bishop ... 377,786
Baling press, O. B. Kinnard ... 377,942
Band coupling, C. A. Weed ... 377,971
Band cutter and feeder, O. Anderson ... 377,975
Bar. See Claw bar. Grate bar. Structural bar.
Barrel hoop, C. S. Cannon ... 377,793
Bath apparatus, portable vapor and hot air, J. G. Davis ... 377,886
Battery. See Galvanic battery.
Bedstead brace, D. G. Warfield ... 378,028
Bell, electric, J. P. Tirrell ... 377,916
Bit. See Bridle bit.
Blast furnaces, apparatus for filling, S. Thomas ... 377,873
Board. See Pitch board.
Boats, outrigger for, M. E. Bosca ... 377,986
Boiler, H. Warden ... 377,792
Boiler heads, apparatus for making, H. Warden ... 377,791
Bolt, H. B. Ives ... 378,067
Bolt threading machine, J. A. Becher ... 377,981
Book protector, P. F. Van Everen ... 377,968
Books, binding blank, T. Beckett ... 377,880
Boot crimping frame, E. Houd ... 377,898
Boot or shoe, G. T. Chapman ... 378,040
Boot or shoe, C. H. Winter ... 378,084
Boots or shoes, tool for inking the sole edges of, F. P. Buzzell ... 377,846
Bottle, ink, E. B. Snedigar ... 378,022
Bottle washer, A. Von Schade ... 377,875
Box. See File box. Knockdown box. Paper box.
Brace. See Bedstead brace.
Bracket. See Lamp bracket.
Brake. Car brake.
Breastpin safety catch, J. Johnson ... 378,054
Brick machine, R. N. Ross ... 377,778
Brick machine, reciprocating, J. P. Miller ... 377,767
Bridge, T. D. Brochocki ... 377,887
Bridge gate, draw, D. Greenhoot ... 377,807
Bridle bit, R. O. Burgess ... 377,845
Bridles, overdraw check loop for, N. B. Le Blond ... 377,944
Burner. See Gas burner.
Burnishing machine, A. B. Fowler ... 377,836
Button, J. P. Noyes ... 377,708
Buttonhole barring, machine, H. M. Essington ... 377,931
Calculating machine, F. L. Bancroft ... 377,823
Calipers or dividers, J. Stevens ... 377,868
Car brake, automatic, W. B. Turner ... 377,874
Car coupling, G. F. Brown ... 377,882
Car coupling, P. Brown ... 378,037, 378,038
Car coupling, J. K. Freeman ... 377,746
Car coupling, S. D. Locke ... 378,013
Car coupling, G. D. Pearson ... 377,770
Car coupling, A. Story ... 377,841
Car coupling, automatic, E. Latham ... 378,068
Car, express, J. W. Post ... 377,774
Car heater, Gilbert & Long ... 377,934
Car road, street, W. M. Eccles ... 377,930
Car, stock, R. H. Ripley ... 377,959
Cars, draw gear for street, J. W. Evans ... 377,825
Card gilding machine, Padmore & Gillbee ... 378,018
Carpet stretcher, J. Carter ... 377,847
Cartridge shell, Stiner & Darling ... 377,816
Case. See Label case. Show case.
Casting loose pulleys, mould for, J. McCaffrey ... 377,859
Chain, drive, S. D. Locke ... 377,811
Chain wrench, J. H. Williams ... 377,795
Chair. See Office chair.
Chimney, adjustable, Jones & Elser ... 377,899
Chronometer escapement, P. T. A. Rodeck ... 377,839
Churn motor, Stuart & Gubbins ... 378,059
Cigar bunching machine, A. Gordon ... 377,748
Clamp. See Saw clamp.
Claw bar, W. S. Pates ... 377,957
Clock, secondary electric, W. B. Harvey ... 377,895
Clock striking mechanism, E. Groux ... 377,985
Clutch, friction, J. W. V. Rawlins ... 377,777
Coat hook, C. C. Pierce ... 377,773
Coffin depositor, A. M. Lewellen ... 377,834
Collar pad, horse, F. W. Krause ... 378,055
Comb, J. P. Noyes ... 377,769
Combination lock, O. Volkerts ... 378,027
Compasses, draughtsman's, J. Stevens ... 377,867
Conveyer, A. Wissler ... 377,821
Copper, salts, ores, mattes, etc., in acids, separating precious metals and impurities from solutions of, T. Kiddie ... 377,809
Cork extractor, E. Walker ... 377,790
Cork retainer, Heinig & Leidigh ... 378,007
Cornet tremolo attachment, F. Menzenhauer ... 377,860
Corsets, making, Stiegler, Jr., & J. Cargemel ... 378,023
Cotton press, A. D. Thomas (r) ... 10,902
Coupling. See Band coupling. Car coupling. Thill coupling. Water closet coupling.
Crusher. See Harrow and clod crusher.
Cuff holder, J. D. Hall ... 377,758
Cuffs, making, A. Whited ... 378,032
Cultivator and scraper combined, J. A. Scroggs ... 377,781
Cultivator foot, S. R. Estep ... 377,908
Cultivators, lifting spring for, C. R. Davis ... 377,903
Cup. See Oil cup.
Cutter. See Band cutter. Rope cutter.
Damper regulator, J. St. Mary ... 377,785
Dental plugger, W. G. A. Bonwill ... 377,984
Display stand, J. J. Anderson ... 378,035
Domino, S. S. Kimball ... 377,833
Door check, S. H. Giesy ... 377,852
Door securer, S. R. Campbell ... 377,927
Doubling and twisting machines, stop motion mechanism for, H. T. Broadbent ... 377,881
Draught equalizer, A. H. Bales ... 377,978
Draught equalizer, H. McCoy ... 377,812
Electric conductors, support for, M. J. Hart ... 377,894
Electric current indicator, E. P. Warner ... 378,029
Electric machine, dynamo, R. Eickemeyer ... 377,906
Electric machines, current regulator for dynamo, Crowdus & Sutton ... 377,884
Electrical conduit, undergrounded, R. F. Silliman ... 378,021
Electrical conversion, system of, E. N. Dickerson, Jr. ... 377,994
Elevator. See Grain elevator. Hod elevator.
Elevator carriage, C. Haas ... 377,751
Elevator controlling device, Evans & Schwanhausser ... 378,045
Engine. See Gas engine. Petroleum engine. Steam engine.
Extractor. See Cork extractor. Spike extractor.
Fare register and recorder, R. M. Rose ... 377,900
Farm gate J. J. Bughman ... 377,844
Faucet, E. U. Scoville ... 378,030
Feed water heater, G. L. Hagarty ... 377,752
Fence making machine, Heberling & Bernauer ... 377,756
Fence post, J. W. Griswold ... 378,051
Fibrous ware, treating, H. Carmichael ... 377,938
File box, E. E. Baker ... 378,062
File holder, H. C. Yeiser ... 378,072
Filters, apparatus for feeding chemicals to, O. H. Jewell ... 377,758
Firearm, B. Hemming ... 377,854
Fire escape, L. J. Mesner ... 377,766
Fish plate, T. A. Davies ... 377,885
Flanging machine, Ford & Hussey ... 377,909
Frame. See Boot crimping frame.
Furnace. See Hot air furnace. Smoke consuming furnace.
Furnaces, apparatus for heating blast for shaft, J. L. Thomson ... 377,819
Furnace grate, W. H. Heeson ... 378,005
Fuse, electric, P. G. Gardner ... 377,851
Gauge wheel, D. H. Carpenter ... 377,890
Galvanic battery, T. M. Foote ... 377,745
Gas burner, C. B. Todd ... 377,787
Gas engine, R. F. Smith ... 377,962
Gas generator, A. Weyer ... 377,798
Gas light governor, automatic, Greiner & Grupp ... 378,050
Gas meter, F. M. Towl ... 377,967
Gas regulator, automatic, M. J. Amick (r) ... 10,901
Gate. See Bridge gate. Farm gate.
Gate, R. B. Lyon ... 378,056
Generator. See Gas generator.
Grain binder, R. Emerson ... 377,744
Grain binders, cord tier for, P. Hanson ... 377,828
Grain elevator, T. J. Underwood ... 377,917
Grain meter and register, automatic, J. G. Wolfe ... 377,848
Grain scouring machine, R. W. Welch ... 377,919
Grate bar, W. D. Cronin ... 377,740
Grinding machine, J. B. Comstock ... 377,983
Harness rosette, J. W. Grummon ... 377,750
Hat and coat rack, W. L. Caldwell ... 377,737
Harrow and clod crusher, J. T. Leighton ... 378,011, 378,012
Harrow and cultivator, combined, F. Bateman ... 377,980
Heater. See Car heater. Feed water heater.
Heel attaching machine, F. F. Raymond, 2d ... 377,958
Hinge, gate, J. B. Pugh ... 377,910
Hod elevator, H. Curtis ... 377,741
Hoisting and conveying machine, M. W. Locke ... 377,947
Holder. See Cuff holder. File holder. Trace holder.
Hoodwink, Lyman & Johnson ... 377,835
Hook. See Coat hook.
Hook, C. C. Pierce ... 377,772
Hoop. See Barrel hoop.
Horseshoe, J. B. Finch ... 378,046
Hose, rubber, J. Crampton ... 377,801
Hot air furnace, G. G. Wolfe ... 378,061
Indicator. See Electric current indicator.
Inhaler, B. M. Wilkerson ... 378,033
Injector, L. Schutte ... 377,912
Insect screen, J. W. Boughton ... 377,987
Jack. See Lifting jack. Vehicle jack.
Jar fastening, J. M. Keller ... 377,831
Joint. See Pipe joint.
Key. See Telegraph key.
Knob lock, Selleck & Keenan ... 377,815
Knockdown box, H. S. Munson ... 377,813
Label case, J. H. McCartney ... 377,764
Ladder, J. S. Tilley ... 377,966
Ladle, foundry, Goodwin & How ... 377,747
Lamp bracket, L. P. Pell ... 377,907
Lamp, car, Sherburne & Taber ... 377,961
Latch and lock, combined, J. Adams ... 377,735
Latch, night, W. Bohannan ... 377,983
Lathe, C. H. Russom ... 377,779
Lathe feed, Jones & Rogers ... 377,761
Lead or base bullion in smelting from slag, etc., apparatus for separating, W. B. Devereux ... 377,802
Leather, machine for staking, stretching, and softening, W. M. Hoffman ... 378,006
Level and inclinometer, spirit, E. F. St. John ... 377,870
Lifting jack, carriage, D. Simmons ... 377,784
Liniment, A. E. Banks ... 377,979
Lock. See Combination lock. Knob lock. Nut lock.
Locomotive smoke conduit, B. T. Loomis ... 378,014
Lubricator. See Axle lubricator.
Match machine, L. Kittinger ... 377,943
Match machine tray, L. Kittinger ... 378,010
Measure, automatic grain, C. W. Hadley ... 377,896
Medical apparatus, electro, T. R. Ten Broeck ... 377,872
Metal working machine, compound, E. S. Babcock ... 377,976
Meter. See Gas meter. Grain meter.
Millstone feeder, L. E. Kane ... 377,762
Mirrors and other articles, pneumatic holder for, C. E. Dougherty ... 377,995
Mop and brush, combined, A. W. O'Blenus ... 377,955
Mortising machine, R. S. Greenlee ... 377,749
Motor. See Churn motor. Weight motor.
Multiple switch boards, long distance connection for, C. E. Scribner ... 377,914
Nail. See Shoe nail.
Nippers, cutting, R. H. Johnson ... 377,759
Nut lock, W. A. Jordan ... 378,008
Office chair and operating table, combination, F. E. Graves ... 377,806
Oil cup, E. P. Shaffer ... 377,782
Ordnance, breech-loading, A. Noble ... 377,906
Ordnance, hydraulic loading and operating mechanism for, R. T. Brankston ... 377,924
Ordnance, hydraulic operating mechanism for, C. H. Murray ... 377,905
Ordnance, hydraulic operating mechanism for breech-loading, C. H. Murray ... 377,904
Ordnance, operating, A. Noble ... 377,954
Oven, reel, C. Stewart ... 377,965
Pad. See Collar pad.
Paint for coating ships, E. L. Kitchingman ... 377,810
Paper box or pail, S. E. Baker ... 377,977
Paper or other material, fastener or holder for, C. M. Durnil ... 377,824
Pavement, artificial stone, F. F. Gibford ... 378,009
Pencil sharpener, W. N. Wheless ... 377,974
Petroleum engine, A. Spiel ... 377,986
Pin. See Printing press gauge pin.
Pinion cutting machine, F. Leman ... 377,945
Pipe joint, M. C. Bowers ... 377,988
Pitch board, adjustable, G. W. Oliver ... 378,069

DESIGNS.

TRADE MARKS.

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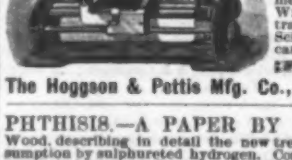

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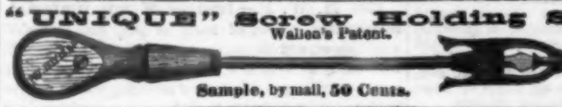

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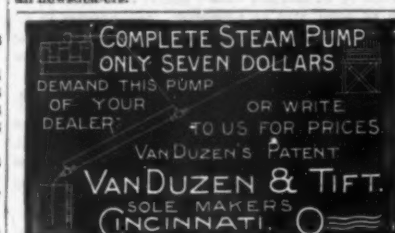

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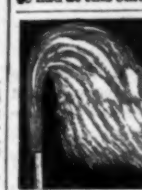

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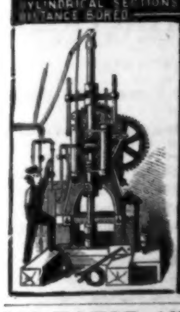

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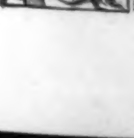

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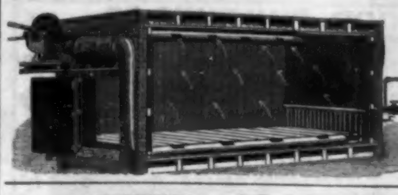

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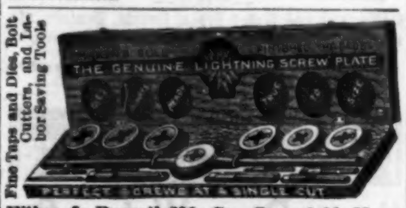

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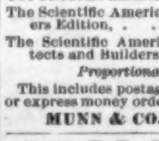

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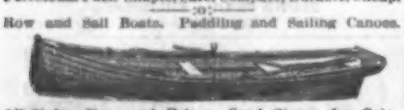

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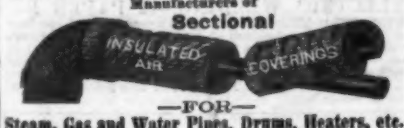

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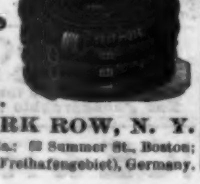

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